

VOL. V. No. 1, Abs. 1-160

MARCH, 1935



IMPERIAL BUREAU OF FRUIT PRODUCTION

HORTICULTURAL ABSTRACTS

Published by the Imperial Bureau of Fruit Production, East Malling, Kent, England

Price 4/- *Annual Subscription, 15/-*

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HORTICULTURAL ABSTRACTS

VOLUME V

Part 1 issued March, 1935

Part 2 „ June, 1935

Part 3 „ September, 1935

Part 4 „ December, 1935

Compiled and published by the

IMPERIAL BUREAU OF FRUIT PRODUCTION AT EAST MALLING,
KENT, ENGLAND

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VOL. V.

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No. 1.

Abstracts. Initialled abstracts in the present number are by J. L. Edgar, H. Shaw, and H. M. Tydeman.

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Horticultural Abstracts

Vol. V

March, 1935

No. 1

HORTICULTURE—MISCELLANEOUS.

1. MIDDLETON, H. E. AND OTHERS. 631.459
The physical and chemical characteristics of the soils from the erosion experiment stations—First and second reports.
Tech. Bulls. U.S. Dept. Agric., 316, 1932, pp. 51, and 430, 1934, pp. 62, bibl. 22.

These bulletins give much physical and chemical information on 11 soil profiles from different stations where soil erosion is being observed under varying conditions. The determinations made include mechanical analyses, chemical analyses of soil and colloid, specific gravity, field volume weight, porosity, dispersion ratio, erosion ratio, moisture equivalent. An interesting practical point is provided by a study of the eroded material. When this is large, it is similar in character to the whole soil, when slight the fine material predominates. Hence slight erosion may do more harm to fertility than severe erosion. Data are now available for 2 years only, but the work is being continued.

2. SUMMERBY, R. 581.084.2
The value of preliminary uniformity trials in increasing the precision of field experiments.
Tech. Bull. Macdonald agric. Coll., 1934, 15, pp. 64. bibl. 9.

The discussion concerns itself with the analysis of records on the cropping of mangels, alfalfa, maize, oats, clover and timothy over a period of 9-12 years. In the early years one kind of crop was grown in successive years, but a rotation of maize, oats, clover and timothy was followed during the greater part of the period. There were four ranges of land, approximately $\frac{3}{4}$ acre each, uniformly treated and harvested in plots 20×20 or 20×100 links. Error variations were calculated for the unadjusted yields in five different plotting plans. It was found that there was a great difference in variation for the same crop on the same land for different years, and also in variation for the same crop in the same year on different ranges of land. Relative precisions of single plots distributed in various ways were then calculated, and interannual correlations were made. In general the correlation coefficients are lower, when the plots are assumed to be distributed at random within blocks, than when they are distributed over the whole range. There is very much variation in the improvement of precision when the trial yields are adjusted by the preliminary yields, and it is shown that duplication in the trial year gives a better result. Average yields over four and five years are also taken as a basis for adjustment, but there are no consistent differences between the relative precision attained in this manner and that obtained from single yearly yields. The highest relative precision was obtained when the preliminary and trial years involved the same crop. Finally, it is shown that when using plots of both sizes a greater precision is obtained by using local control than by

adjustment for previous yields. In conclusion the writer states that under the conditions of this experiment, replication in the year of the trial is more effective in increasing precision than adjusting the yields by means of preliminary uniformity trials, although these may be useful in determining suitable plotting plans, and eliminating unsuitable areas of land. [It has been found that in experiments concerned with crops of a more permanent nature than those in the experiment described this method of adjusting experimental yields is of very great value.—Abstractor.] J.L.E.

3. COOMBS, A. V.

581.084.2 : 519

The border effect in plot experimentation.

Emp. J. exp. Agric., 1934, 2 : 315-23.

The results of four field experiments on kale and sugar beet, in which the edge rows of the plots were harvested separately, are utilized for the study of border effect. Standard errors are calculated for plots including and excluding the edge rows. In general, discarding the edge rows has no deleterious effects on the efficiency of the experiment, as no appreciable increase in the standard errors results. Factors which may bias the yields of the edge rows are described, and it is shown that both positive and negative biases are possible. Where the plots are narrow or very small the retention of the edge rows results in a decidedly biased estimate of the treatment differences due to the trespassing and competition effects on the edge rows. In the case of some manurial experiments, however, the discarding of the edge rows may give more biased results than their retention, owing to the unequal distribution of the manure. Finally, a method for the estimation of the edge effects is described. J.L.E.

The following also is noted :—

WOODS, J. J. **Hop growing in British Columbia.** *Mimeographed pamphlet*, 1934, *Dom. Dep. Agric. Canada*, pp. 3.

TREE FRUITS, DECIDUOUS.

General.

4. FOWLER, R.

634.1/7

Government experimental orchards, Blackwood and Fullarton.

Bull. Dep. Agric. S. Aust., 294, 1934, pp. 141-51.

Stock trials. Under conditions at Blackwood the superiority of the mazzard (*Prunus Avium*) stock to mahaleb (*P. Mahaleb*) and Kentish cherry (*P. Cerasus*) stocks in producing larger, thriftier and more productive trees is very marked. For pears Angers quince has been generally successful : it produces a smaller tree than is usually the case on pear seedlings. Certain pears, e.g. Beurré Easter, will not "take" and are complete failures when directly grafted on quince. As the pear woolly aphid is now threatening to be dangerous, preliminary investigations are in progress to find a resistant stock. Peaches grow better on peach stocks at Blackwood than on the others tried which have included almond, myroblan, apricot and peach-almond. As regards apples a collection of East Malling stocks has been planted out and will be tested with commercial varieties as soon as sufficient material has become available by means of vegetative reproduction. Selection has also been made of different strains of Northern Spy stock and of myroblan plum stock and the selections are to be worked up in numbers vegetatively and tested. Small scale manurial trials which have been in progress for some 24 years at Blackwood, on apples, pears and peaches, seem to show that the use of superphosphate alone is uneconomical, that potash unless combined with superphosphate and sulphate of ammonia tends to decrease rather than increase yield, and that nitrogenous manures when added to superphosphate or to superphosphate plus potash appear to give increased yields. No test has been made of nitrogenous manuring alone. Spraying work is in progress against codling moth and against green peach aphid. Tar distillate washes have so far proved quite effective against the latter.

5. INSTITUT FÜR OBSTBAU, BERLIN. 634.1/7-1.16
Arbeits- u. Materialbedarf, Anlage- u. Unterhaltungskosten im Obstbau.
(The labour and materials necessary for fruit growing together with costs of
planting and upkeep.)

Merkbl. Inst. Obstbau. Univ. Berlin, 3, 1935, pp. 8.

The figures given here are intended as a rough guide for the novice and a comparative standard whereby the established fruit farmer can see where his own costs or returns are unsatisfactory. Costs of material are reckoned per morgen (=about .255 ha. or .63 acres) and the labour is worked out for all operations as so many man and horse hours. The crops costed in this way include standard and bush apples, sour cherries, currants, raspberries and strawberries. An interesting diagrammatic table shows the cultural operations considered necessary throughout the year for these crops. Notes on pollination difficulties in apple, plum and pear varieties are given while exact figures are set out of the number of trees necessary for planting up a morgen at different distances apart and the time likely to elapse before crops can be expected.

6. CASELLA, D. 634.21-1.541.11
L'albicocco. (The apricot.)

Ann. Staz. Agrum. Frutt. Acireale, 1934, 1 (N.S.); 123-48.

The author considers world apricot production and the markets for fresh and preserved fruit. The United States (almost entirely California) is much the largest producing country; Spain comes second with Italy or Australia third. Notes are given on varietal characters and the fruits of some 21 varieties are portrayed on 21 plates. The Italian grower is advised to concentrate on particular named varieties according to what he proposes to do with the product. An interesting account, based only on observation and practice, is given of the rootstock question. *Apricot* stocks. These are generally compatible with all varieties. Growth and fruiting is initially slow, but the trees are vigorous, long lived and, generally speaking, more resistant to gummosis than those worked on plum. They are, however, not resistant to root rot. *Plum* stocks. Various types including myrobolan and mariana, S. Giovanni and S. Paolo, are useful for wet compact soils. They show greater resistance to root rot, but have the disadvantages of forming suckers in great numbers, of showing hypertrophy at the union and of being somewhat susceptible to gummosis. *Peach* stocks. A peach stock is preferred for early varieties, on medium, fresh, deep soils. It is generally fairly compatible, though the diameter of its stem is generally greater than that of the scion. It induces early and heavy fruiting, the fruits being large, well coloured and very fragrant. It results in a drought-resistant tree much less liable to break at the union than that on *almond* stock. The last is used on very dry hillsides. The resulting tree is drought resistant, but compatibility is poor and breaking often occurs at the union. This may be overcome by using peach as an intermediate stock.

7. ANAGNOSTOPOULOS, P. T. 634.37
Types of fig in Greece. [Greek-English summary.]

The Greek Fig Producer [Transl. title*], 1934, 1: 4-14.

There are 4 types of fig commonly grown in Greece. (1) *The caprifig*. This bears 4 crops in the year. The first appears in April and matures in May-July, the second matures in July or August, the third in October, the fourth in the winter. In each a generation of *Blastophaga grossorum* is raised naturally. The insect overwinters in the last crop to reappear in the spring and enter the first crop in April. (2) *The two-crop fig*. This gives 2 full crops, maturing its first crop parthenocarpically on last year's wood in June, and a second crop in July or August after being visited by *Blastophaga* in June. (3) *The semi two-crop fig*. This gives a small crop on the last year's wood, but these figs do not mature parthenocarpically and only ripen with the second crop in July to August after fertilization in June. This is represented in Greece by the Smyrna, the Calamata and other figs, being grown for the dried fig trade and for use in the fresh condition. (4) *The one-crop fig*. This gives one crop only which matures from July till late autumn.

* ΕΛΛΗΝΙΚΗ ΣΤΟΙΧΑΡΑΓΟΓΗ.

Fertilization is not essential and the fruits will mature parthenocarpically. The author introduced *Ficus Pseudo-Carica* in the hope of thereby helping the pollination of the 2-crop type. Unfortunately at Athens at any rate the winter temperature is too low for the winter crop.

8. FURNEAUX, B. S.

634.1/7-1.4

Selection of soils for dessert apple growing.

Sci. Hort., 1935, 3: 42-54.

The author, who deals with English conditions, utters a plea for the intelligent use of the soil auger, a description of which is given. A useful length allowing the boring of a hole 3 ft. 6 in. deep will be 3 ft. 8 in. Each foot and half-foot can be marked with a ring by means of a file. Its use provides a series of vertical sections through the whole depth of the soil. It is quite erroneous to think that all gravels will produce good dessert apples. It depends entirely on the soil binding the gravel together and this needs examination no less than other soils. It is not necessary to secure a deep soil for success. One 14 in. or more deep will usually serve. If, moreover, the underlying geological material is open in structure, neither very heavy nor very light but allowing good root penetration, soils as shallow as 10 in. may be considered. Good drainage is essential. This may be assumed if the soil colour is free from mottling, especially from an orange brown and grey mottling which clearly denotes waterlogging. Close scrutiny is often necessary to determine whether mottling is present or not. Sometimes brown concretions of iron oxide, "crowstones", occur, showing by their position where any hold up in drainage has occurred. It is inadvisable to plant dessert apples where they are accumulated less than 12 in. from the surface or present in any large amount down to 24 in. If the underlying material brought up by the auger is a clay, it should be bent between the fingers, when it will break readily if it contains cleavages ensuring good drainage, but will stretch like putty if there are no such cleavages and the drainage is bad. One form of drainage deficiency commoner than is supposed is that due to the presence of underground springs. These are common in deep alluvial soils and produce a mottling or iron oxide accumulation at 2 to 3 ft. from the surface. Where such waterlogging occurs closer to the surface stunting of the trees and leaf scorch result, but where the spring water runs deeper the effect is that the trees produce rank growth and a great deal of foliage. Such conditions will not suit a dessert apple. In low-lying lands a water table too close to the surface may prevent success. In south-east England growing dessert apples is seldom satisfactory when it is nearer to the surface than 3 ft. A warning is given of the great variation in different soils lying close to one another. This can and should be disclosed by the use of the auger.

Breeding.

9. WENHOLZ, H.

634.1/8-1.521

Plant breeding in New South Wales.

Sci. Bull. Dep. Agric., N.S.W., 45, 1934, pp. 58 (Fruit breeding, pp. 49-58).

This describes work in the seventh year of progress, namely 1932-3. *Apples*. One of the chief objectives is the production of a late ripening, well-coloured apple possessing the good keeping qualities of Granny Smith, and the latter is accordingly being crossed with good red varieties. A list of good fertilizers for Granny Smith is given. *Pears*. Setting of fruit in the Williams pear was increased from 5% to nearly 30% by cross pollination. Practically all commercial varieties blooming at the same time are capable of successfully pollinating it. In testing the effect of different cage material on the parthenocarpic setting of fruit in the Williams, marked differences in light, humidity and temperature were found to occur in the different cages, which were of glass, wire, cheesecloth, butter muslin, hessian and calico, the darkened cages giving the highest set of fruit. *Plums*. A search is in progress for good pollenizers for various Japanese plums. *Cherries*. In a search for improved varieties seedlings of St. Margaret appear likely to blossom in their third year, while later crosses of Napoleon and Florence have also made good growth. *Peaches*. Attempts are being made to evolve improved varieties both for dessert and canning. Thrips invasion has hindered the work. *Nectarines*. The aim is new early and late

varieties of equal merit to the mid-season variety of Goldmine. *Almonds*. The varieties in cultivation can be grouped as early flowering or late flowering. Most of the varieties in each group give poor set of fruit when self-pollinated but are readily cross-pollinated. *Apricots*. Seedlings from Moorpark, Trevatt and Alsace are about to be tested as also seedlings from Turkestan seed. *Grapes*. One of the chief aims is the production of a good flavoured, black variety of good handling and keeping qualities. Brown Muscat, Black Malaga and others have therefore been crossed with Ohanez, but so far without great success. Other aims are good direct producer varieties and good seedless or nearly seedless varieties. *Citrus*. The chief object is a late-ripening navel or a later ripening orange than Valencia. *Passion Fruit*. A search is being made for varieties resistant to woodiness and brown spot. *Strawberries*. Tests are in progress on a number of imported varieties, while a new cross-breeding programme has been started in the hope of evolving improved varieties resistant to leaf scorch, *Mollisia Earliana*.

Propagation.

10. CASELLA, D. 634.63-1.541.11 : 635.976.32
L'innesto dell' olivo sui lilla (*Syringa vulgaris* L.). (Lilac as a rootstock for olives.)

Ann. Staz. Agrum. Frutt. Acireale, 1934, 1 (N.S.) : 211-4.

In his attempts to find a rootstock inducing early fruiting in the scion the author has shown that the olive can be induced to fruit in the second year from the bud by working on lilac. Not all lilacs are suitable and he is starting a selective study of them this year. It is suggested that such a rootstock, producing dwarf trees which come quickly into production, should be of the greatest use for three purposes in particular, firstly for olive breeding work by obtaining quick results of crosses, secondly for the production of uniform small trees easily managed and thirdly for the production of ornamental trees.

11. LEK, H. A. A. v.d. 631.535 : 581.144.2
Over den invloed der knoppen op de wortelvorming der stekken. (Influence of the buds on root-development in cuttings.) [English summary, 9 pp.]
Reprint from *Meded. Landb.Hooges. Wageningen*, 1934, deel 38, verhandeling 2, pp. 95, bibl. 18.

The experiments were carried out with *Populus* spp., mainly *P. candicans*, from Nov. 22-Feb. 11. The significance of this choice is that the cuttings possess pre-existing root-primordia and that the roots do not start entirely *de novo* as for instance in the case of vines. The cuttings were rooted in water in the dark in a warm greenhouse. Those used were always divided into two parts so that each provided a basal and an apical section. In the first series the root formation of cuttings provided with buds was compared with wholly disbudded cuttings (one year old twigs of *P. candicans*). The following conclusions are drawn. In cuttings taken during dormancy the buds have a checking influence on root development both with regard to the number of roots and their total development. The root development of the apical parts is stronger than that of the basal parts (in *P. candicans*). This difference is also shown by the disbudded cuttings. The degree of checking caused by the buds is closely connected with the phase of development of the buds, the check progressively decreasing as the buds approach the end of dormancy. This awakening of the buds from dormancy in 1-year-old shoots appears to progress successively from the base to the top. In experiments this fact sometimes masks the stronger tendency to root development of the apical portions of cuttings which have not been disbudded. Thus it may be accepted that during dormancy buds have a checking influence on root development while later their effect is stimulating. In a second series of experiments the following conclusions were reached. The periodicity of the mother plant influences root development in the cuttings even after the elimination of the stimulating effects of buds. The periodicity, i.e. reduction of root development during dormancy, which is shown by the axis itself, is increased by the influence of dormant buds in proportion to the length of the period before the end of dormancy. The question whether the buds exercise such an influence on

the periodicity of the shoots while still on the tree appears to be answerable in the negative, but the evidence is admittedly inconclusive, since observations on trees of which some twigs only have been disbudded while the majority remain intact is obviously insufficient. Further experiments on this point are in progress.

12. LUGEON, A. R. 631.541.44 : 634.22 + 634.23
Top-grafting cherries and plums.
Gärtners' Chron., 1935, 97 : 98.

The statement made in a previous issue (*Ibid.*, p. 58) that cherries and plums do not lend themselves to top-grafting is contested. In Switzerland the top-grafting of plums and cherries by cleft or crown grafting is a common and successful practice, but in the case of cherries the operation must be done in the second half of September, since spring grafting is irregular in its results. Only mature wood is used. An extra thick coating of wax should be given, as the grafts will have to remain till the spring before they start growing. Plum trees are top grafted in the same way, but in spring, and 100% success is said to be usual. The age of the tree should not exceed 15 years.

13. PEScott, E. E. 634.1/2-1.541.44
Changing the variety of fruit trees. Some modern methods.
J. Dep. Agric. Vict., 1934, 32 : 517-22, 535, bibl. 4.

Methods are described whereby fruit trees can be worked over to another variety with less risk of disease and with quicker results than by the old method of heading back the tree and wedge grafting scions on to the extremities of the cut back branches. The methods advocated here are: (1) *Budding or grafting on laterals*. Old laterals and spurs are cut away and the fresh growths are budded at the base with the new variety as soon as they are ready, or whip tongue grafts are inserted on suitable old laterals in spring and later on new laterals. (2) *Peg grafting*. The tree is denuded of its laterals which should be cut completely away. The top of the leader should be cut far enough up to allow an ordinary whip tongue graft to be placed at its extremity. The scions for peg (plug, porcupine or chisel) grafting are 3-4 in. in length, cut to wedge shape at the base, on a short bevel $\frac{1}{2}$ in. long, a bud being left at the beginning of the wedge cut. Incisions are made with a chisel $\frac{3}{8}$ in. or $\frac{1}{4}$ in. in width the bevel of which has been ground down to double its original length, the ordinary chisel bevel being too short for grafting work. A mallet is used in conjunction with the chisel. The cut should be right into the wood at right angles to the growth. The incisions should be made along the upper side of the limbs about 1 ft. apart, and scions when inserted are driven right home by the mallet until no white cut portion is showing. Scions should not be inserted till all incisions have been made or the tapping may cause displacement. The sealing is done with grafting wax of which a most successful preparation is 1 tablespoon of powdered starch to $1\frac{1}{2}$ pints of colas, the mixture to be stirred until the starch is cooked. To thicken add starch, to thin add colas. Resealing is usually necessary a fortnight later. (3) *Bark grafting* consists of placing the cut face of the scion in contact with the cambium just under the bark. The cut face is usually 1 inch in length but may be longer. A basal bud on the scion is imperative. The scion is frequently fixed in place by a small tack and sealed. A good method of reworking a tree is to peg graft the large wood, bark graft the thinner and higher parts, and set a whip tongue graft at the top.

Pollination.

14. MOFFETT, A. A. 634.13 : 576.312.32
Chromosome number and pollen germination in pears.*
J. Pomol., 1934, 12 : 321-6, bibl. 7.

Most of the material for cytology and pollen germination tests came from trees at the John Innes Institution, Merton, other material being provided by the East Malling Station. The author summarizes as follows:—(1) The chromosome numbers in 34 varieties of pear have been determined. 27 were diploids and 7 triploids. Approx. 22% of the varieties examined by various

* See also same author *Genetica*, 15 : 511-8, *H.A.*, 1934, 4 : 4 : 518.

workers have been found to be triploids. (2) The diploid varieties on the whole have a higher percentage of pollen germination than the triploids. The distinction between the 2 classes is not so clear cut, however, as in apples. The optimum concentration of sugar for germination varies with the variety and varies in the same variety from year to year.

15. MORETTINI, A. 634.25 : 581.162.3
 La fecondazione nel pesco. (**Peach fertilization.**)
Ital. agric., 1934, 71 : 1009-28, bibl. 22.

After a review of previous work by MacDaniels and others on pollination of the Burbank plum the author turns his attention to similar work on the peach carried out chiefly in the U.S.A. He next tabulates 4 years' observations on some 36 varieties of peach at the pomological institute at Florence. Tables show the result on fertilization, of sacking the flowers, and of leaving them free. The J. H. Hale peach received particular attention. The author summarizes as follows :— (1) Of the 36 varieties only Hale's is self-sterile and does not produce pollen. (2) The others are self-fertile though in varying degrees. (3) Hale's may be pollinated by Amsden, South Haven, S. Anna, May Flower, Waddel, Carman, Morellone, Elberta. The result of pollinating with *P. Pissardii*, Burbank and almond remains, however, uncertain. (4) As regards time of flowering varieties may be divided into very early, early, intermediate, late and very late with an interval between the flowering of the earliest and that of the latest which amounted to 17 days in 1933. (5) The pollen of all the varieties examined except Hale's showed a high degree of germination capacity. (6) Hale's must be interplanted. With the others, though not essential, interplanting is still desirable.

16. ASAMI, Y., AND HAYAMI, F. 634.13 : 581.162.3
 The growth of pollen tubes in incompatible pollinations of Japanese pears.
J.-hort. Ass. Japan, 1934, 5 : 222-32, bibl. 16.

Prior to microscopic examination the styles were killed in Flemming's strong solution, Carnoy's fluid or Bouin's solution, embedded in paraffin and sectioned. Cotton blue in lactic acid was found preferable to resorcin blue for staining. The authors describe their observations on pollen tube growth both in the open and in the greenhouse with Chojuro, Nijisseki and Waseaka pears. The following notes are from their summary. In self-pollination attempts the tubes moved rather more slowly than in cross-pollination down nearly to the base of the styles. Here their growth was checked and they were unable to effect entry into the ovary. The rate was faster but the result the same under greenhouse conditions. In the incompatible crosses Ichiharawase \times Meigetsu and Taihaku \times Waseaka the pollen tubes had traversed more than $\frac{2}{3}$ of the distance in the styles 7 days after pollination. Their progress was slower, however, than in compatible crosses and the retardation was more marked than it had been in cases of self-incompatibility. Pollen tubes with swollen ends were more often seen in the styles of incompatible pollinations than in those of compatible pollinations.

17. EINSET, O. 634.11 : 581.162.3 : 575.252
 Cross pollination trials with bud mutations of the apple.
Gartenbauwiss., 1934, 9 : 157-8.

The author gives a brief account of attempts to cross Ben Davis and Black Ben Davis ; Duchess, van Buren Red Duchess and Daniels Red Duchess ; Twenty Ounce and a red fruited Twenty Ounce ; and a solid red McIntosh, a striped red McIntosh and McIntosh. In 1933 only one positive result was obtained, the van Buren Red Duchess proving cross fruitful with both of the other Duchess strains. In 1934 the van Buren Duchess was again crossed with the Daniels strain and again gave a full set. The ordinary Duchess trees did not bloom this year. The authors conclude from their experiments that Duchess may be safely grown in solid blocks provided that the van Buren Duchess is interplanted with either of the other two Duchess strains.

18. MORETTINI, A. 581.162.3 : 634.21 + 634.23
Contributo allo studio dell' impollinazione nell' albicocco e nel ciliegio. (*Studies of pollination in apricots and cherries.*)
Ital. agric., 1934, 71 : 1103-12, bibl. 9.

Apricots. The author discusses the results of 2 years' observations on some 14 varieties of apricot grown in Italy. Though all varieties tested proved self-fertile, a comparison of crops from bagged flowers with those from flowers left accessible to foreign pollen shows that a large number of varieties require cross-pollination to produce economic yields. All varieties except the Orleans, a very late one, flowered at practically the same time. Pollen from all varieties showed a very high germination capacity. *Cherries.* Two years' observations with 7 varieties of *Cerasus Avium* Moench and 1 of *C. vulgaris* Mich. showed them all to be self-sterile. Bigarreau Napoleon and Maggese were found to be good pollinators for Turca, while Turca, Regina del Mercato and Maggese were found to pollinate B. Napoleon successfully.

19. MIEDZYRZECKI, C. 634.23 : 581.162.3
La pollinisation chez la cerisier. (*Cherry pollination.*)
Publ. Experimentation fruitière et maraichère, Rabat, 1934, pp. 24, bibl. 26.

This article is addressed particularly to the fruit grower in Morocco. Its chief interest for other cherry growers lies in a concise tabulation of the cherry pollination results of the chief European and American workers on the subject. The cherries are divided for this purpose into 3 classes, (1) *Prunus Avium* (or sweet) 37 varieties; (2) *Prunus Cerasus* (or acid) 4 varieties, and (3) the intermediate *P. Avium* × *P. Cerasus* with 7 varieties. The self-fertility or sterility is noted in each case and notes are given on other varieties known to be good or bad pollinators. A glossary of synonyms of cherry names concludes a useful short paper.

Growth, Nutrition.

20. SMYTH, E. S. 634.11-1.84 : 581.192
The seasonal cycles of nitrogenous and carbohydrate materials in fruit trees. II.
J. Pomol., 1934, 12 : 249-92, bibl. 48.

The work described here on carbohydrate materials took place at Long Ashton and should be regarded as complementary to that on nitrogenous materials done by Karmarkar and described in *J. Pomol.*, 1934, 12 : 177-221, *H.A.*, 1934, 4 : 4 : 526. The investigations were carried out simultaneously on samples taken from the same trees* and on the same occasions with a view to obtaining data on the nitrogen and carbohydrate cycles which could then be utilized to study the C/N ratio over the annual growth cycles of apple trees. Previous investigations and results are discussed and the exact methods of analysis used here are detailed. All results were calculated in terms of the percentage dry weight of the respective plant material, namely, bark, wood and leaves. In discussing the seasonal cycles of individual constituents results are considered with reference to the physiological periods of plant growth described by Karmarkar, namely, period of bud swelling—April and May in England, shoot elongation—June, July and August, full growth—August, September, October, leaf fall—October and November, dormancy—December to March. It was found that the curves representing the cycles for grass and arable plots were almost always similar in form. Seasonal variations occurred in all the constituents examined, namely, alcohol soluble matter, sugars, starch, hemicellulose, cellulose, lignin. The cycles for the constituents in bark and wood are generally similar. The application of a spring nitrate dressing to the grass plot did not appear to affect the form of the seasonal cycles. The concentration of the constituents is also with slight deviations approximately the same for both plots, though the C/N ratios are higher in the grass plot than in the arable plot trees. The main features of the cycles for each constituent are summarized. Certain observations warranted by these results are made with regard to the respective functions of the constituents. The

* Newton Wonder trees on type II stock.

ratios of the various carbohydrates to N and non-protein N show that the ratio very rarely remains constant over 2 consecutive months. Though the curves of the ratios are similar in form for grass and arable trees, the values are higher for the grass plot for the starch and sugar/non-protein N ratios in bark and wood; for the starch/total N in wood; and for starch/both N groups during summer in the leaves.

21. OVERHOLSER, E. L., AND CLAYPOOL, L. L. 634.23 : 581.45 : 581.192
The relation of leaf area per cherry to physical properties and chemical composition.

Gartenbauwiss., 1934, 9 : 95-9, bibl. 13.

One year's data from experiments begun at the Irrigation Branch Experiment Station, Prosser, Washington, in the spring of 1932, are here discussed. The fruit and leaves on branches of 2 trees of Napoleon (Royal Ann) sweet cherries were thinned early in May to give approximately no leaves, one-half, one, two, four and eight leaves per fruit. One lot of branches with each leaf-fruit ratio was ringed and one lot left unthinned. The number of fruits in each treatment averaged 700. Results on the physical characteristics were much more marked on the ringed than on the unringed branches. The earlier fruits harvested were in most cases from ringed branches with a high leaf : fruit ratio. These fruits were of large size and high colour. Whereas in the unringed branches, moreover, decreasing the leaf : fruit ratio other than complete removal of leaves had little effect on fruit bud formation in the following year, on the ringed branches removal of leaves so that less than 2 leaves per fruit were left did result in a serious decrease in fruit buds. Again, the chemical composition of the cherries on the ringed branches was influenced by a higher number of leaves per fruit : thus protein and moisture percentage tended to decrease and percentages of total dry matter, ash, reducing and alcohol insoluble acid hydrolysable materials tended to increase. In the case of the unringed branches, except where all the leaves were removed, changing the leaf : fruit ratio appeared to have no consistent influence on chemical composition of fruits.

22. CHRISTODOULOU, P. 638.22 : 634.38
Mulberry leaves as food for silkworms.
Cyprus agric. J., 1934, 29 : 47-9.

It is important that mulberry leaves fed to silkworms should be in good condition, otherwise the quality and quantity of the silk will suffer. The nutritional value of the mulberry leaf depends largely on the soil on which the tree is grown. Healthy leaves are deep green, sticky and brittle. Wet, dusty or damaged leaves should not be used. Leaves which have to be transported some distance should be loosely packed to avoid fermentation. If the leaves are damp, at least six hours should elapse between gathering the leaves and feeding them to the silkworms, and in any case they should be allowed to acquire the temperature of the rearing room before use. This will take $\frac{1}{2}$ hour. It is claimed that leaves from ungrafted trees are preferable during the first two instars and part of the third. These leaves are more tender and contain less moisture than those from grafted trees and should be cut off close to their base. During the second half of the 3rd and during the 4th and 5th instars leaves used should have the twigs attached and should come from grafted and ungrafted twigs alternately.

23. MANARESI, A., AND LANZONI, D. 634.25-1.547.5 : 551.56
Influenza dell' andamento della stagione sull' allegagione e sulla cascola dei frutti del pesco. (Seasonal influence on set and fall of fruits in the peach.)
Ital. agric., 1934, 71 : 1002-8, bibl. 7.

The varieties on the fruit fall of which observations were made both in 1928 and 1929 were Amsden and S. Anna. The year 1927 was normal in Italy, consequently vegetative growth proceeded regularly, so that in the spring of 1928 abundant, well formed fruit buds were in evidence. Fruits set plentifully and began to drop in considerable numbers in the weeks immediately after flowering. This fall continued with varying intensity until ripening, being

particularly marked during rainy or overcast weather. In the following winter, owing it is suggested to the dryness of the preceding summer, fruit buds were fewer. They were, moreover, damaged both by the winter frosts and later by late spring frosts. Flowers consequently were few and many fell off shortly after opening as the result of the spring frosts having damaged the ovaries. The fall was very noticeable between April 17th and 25th. From April 25th to 29th it became less and thereafter nearly ceased. In both years the weather obviously had the greatest possible effect on the incidence of fruit fall. As regards set of fruit, this appeared to be best in flowers which opened about half-way through the period of anthesis on days with little rain or with fine intervals or fine.

24. ASAMI, Y., AND KADOTA, T. 581.144 : 577.15.04 : 634.1/8
Effect of thiourea upon apical dominance of tree branch.
J. hort. Ass. Japan, 1934, 5 : 300-5.

Single stem apple seedlings were placed upside down in a cylinder containing a 2% water solution of thiourea, so that the upper $\frac{1}{3}$ to $\frac{1}{2}$ of the stem was soaked. After soaking for various lengths of time, viz. from 40 minutes to 23 hours, they were rinsed with water and replanted. The check plant was soaked in water only. Observations on growth showed that the check plant grew only 1 shoot which sprouted from the terminal bud, displaying complete apical dominance. In the treated plants each had several shoots on the upper soaked portion of the stem, while no buds sprouted on the lower part of the stem, nor did the terminal bud nor one or two adjacent buds. Secondary growth on the treated shoots was not so affected. Similar treatment of grape cuttings resulted as follows:—In all lots, treated and untreated, the terminal eye and the eye next to it sprouted, while the buds below did not grow. But the average shoot length was shorter in the shoots from the terminal eye than in those sprouting from the adjacent eye in the lot treated with thiourea, while the reverse was the case in the untreated lots. As regards the vine the authors were working with lots of 6 cuttings in each treatment, whilst in the case of the apples they were apparently working with 1 seedling per treatment.

25. KIDD, F. 581.11 : 634.11
The respiration of fruits, being a paper given before the Royal Institution of Great Britain on Nov. 9, 1934, pp. 33.

The author traces the course of respiratory activity in the apple fruit from petal fall till functional breakdown. He divides it into the following stages:—*Cell division*, i.e. from petal fall for about 3 weeks, *cell enlargement* when cells increase not in numbers but in size, *maturity* when aroma and flavour are developing up to time of fall from tree, *senescence*, life as detached organ, *functional breakdown*. He finds that the most suitable measurement of respiratory activity is the rate of CO_2 production per unit cytoplasm or living matter of the cell, considering the cell wall and vacuole as external to the actual system which is respiring. He then shows how this fluctuates throughout the life of the fruit and he offers an explanation based on the chemical changes which are in progress. He summarizes his main conclusions as follows:—Respiratory activity is primarily a function of the concentration of active or γ -fructose in the cytoplasm; further, prior to the climacteric (a critical change at maturity when respiratory activity quite suddenly rises sharply) the vacuole acts as a sink for fructose, so that glucose is the only source, through the operation of a conversion mechanism in the cytoplasm, of active fructose. The climacteric marks the end of the isolation of fructose, its presence thereafter in the cytoplasm being responsible not only for the rise in respiratory activity but also for the progressive degeneration of senescence. The entrance of fructose into the cytoplasm requires certain conditions of acidity in the cell and also the presence of oxygen. Ethylene, in the presence of oxygen, probably promotes this entrance. The author notes that research has now disclosed 3 powerful agencies for regulating the span and speed of life in fruits. These are ethylene to accelerate ripening, CO_2 to depress respiratory activity, retard ripening and lengthen life, and lastly atmospheres poorer in oxygen than air to reduce the pitch of respiratory activity and also delay the onset of the climacteric and to retard ripening.

Manuring, Cultural Practice.

26. COLLISON, R. C., AND HARLAN, J. D. 634.11-1.8-1.415'
Fertilizer responses of Baldwin apple trees on an acid soil.
Bull. N.Y. St. agric. Exp. Sta., 646, 1934, pp. 24.

The tests were made on 40-year-old trees, vigorous and exceptionally uniform. The surface soil reaction varied in 1930 from pH. 4.5 to 5.2, but at a depth of 30 to 36 inches there is abundance of lime. The arrangement of treatments in the experimental block was not strictly random, the orchard being divided into 10 different blocks, in each of which every treatment occurred once. Thus the 10 trees of each of the 17 treatments were scattered over the whole orchard and this minimized the effects of soil variations. The fertilizer treatments were made on each tree as an individual unit. Various nitrogen carriers and fertilizer combinations were tried over a period of 4 years. Those which carried nitrogen entirely or predominantly in ammonia form and with which no provision was made for correcting potential acidity gave lower yields, a smaller proportion of marketable sizes of fruit and less terminal growth than fertilizers carrying nitrogen in other forms. The application of lime entirely altered the results which followed ammonium sulphate applications to this acid soil from very poor to good in 2 years. The lime treatment given was incidentally too small to nullify soil acidity. Potassium nitrate gave outstanding results on yields, quality of fruit and leaf and terminal shoot growth.

27. HENDRICKSON, A. H., AND VEIHMEYER, F. J. 634.22-1.67
Irrigation experiments with prunes.
Bull. Calif. agric. Exp. Sta., 573, 1934, pp. 44, bibl. 7.

In the interior valleys of California, where these tests took place, temperatures sometimes reach 110° F. in summer and 25° F. in December and January. The annual rainfall for the 10 years averaged 14.7 inches. Evaporation in summer is considerable. The experimental orchard covers 3.2 acres. Planted in 1917 with selected 1-year-old nursery stock it consists of 13 rows of 15 trees each of Agen prune on myrobalan stocks. Until 1923 all trees were treated uniformly. In the experiment which started in 1923 the plots for the different treatments were selected according to the growth measurements of the trees for the first 6 years after planting, the trunk girth measurement being the sole index to growth used from 1920 onwards. In grouping for the various treatments plots of high variability in size were placed with those of low variability. The treatments consisted in wetting the soil by the basin method to eliminate the dry portions, which in furrow irrigation usually hamper the interpretation of soil moisture data. The amounts given were based on the amounts in the soil. The 4 different treatments were as follows:—(1) Plots kept supplied with regularly available water. (2) Plots irrigated before, but not after July 1st. (3) Plots not irrigated until after July 1st. (4) No water added to soil during growing season. The calculations involved, the readings taken and details of soil moisture percentages during the years 1923-1932 are here presented in tabular form and graphed. The following few notes are taken from the comprehensive summary of results. Growth and yields were affected as much by the lack of readily available moisture for a relatively short period in mid-summer as for a longer period late in the growing season. No winter injury was seen during the 10 year period whatever the irrigation treatment. During the first 5 years of the experiment no differences in yield could be attributed to the irrigation treatment. Thereafter the cumulative yields from the trees kept continuously moist averaged largest, those from the intermediate treatments next and those from the unirrigated treatment least. Lack of readily available moisture during the fruit growing period seriously affected the growth rate of fruit which remained smaller irrespective of later irrigation. Results indicate that applying water to a prune orchard shortly before the moisture content of the top 6 ft. of soil is reduced to the permanent wilting percentage constitutes good irrigation practice.

28. COLLINS, J. F. 632.932
Treatment and care of tree wounds.
Fmrs.' Bull. U.S. Dep. Agric., 1726, 1934, pp. 38.

About a third of this bulletin is devoted to a consideration of tree growth and of the various agencies responsible for injury. The remainder deals in detail and with illustrations with the

most important operations in tree surgery. The principles governing all such work should be :— Remove all decayed, diseased or injured wood or bark, sterilize or use a good sterilizing dressing to protect all cut surfaces from external moisture and other injurious external agencies, leave the work in the best state for rapid healing, watch the work afterwards for defects and repair these at once. The following processes are then described :—*Guying and bracing* tree limbs to obviate or check splitting, care being taken that any holes made to contain hooks or eye bolts should be treated with creosote or like substance. *Removal of branches*, the essential being first that all decay is removed and second that no tearing of the bark is occasioned by faulty cutting methods. A good coat of shellac varnish should be applied at once over the entire cut edge of the bark, the outer sap wood and the cambium. *Sterilizing and dressing* wounds with such mixtures as creosote and coal tar (about $\frac{1}{4}$ or $\frac{1}{2}$ creosote), or creosote in equal parts with asphalt. The creosote and tar mixture is liable to cause injury when used around wounds on certain trees especially cherries, peaches and plums. In such cases the use is suggested of copper sulphate solution (1 lb. CuSO_4 to 3 or 4 gallons water) or a 1 in 1,000 solution of the poisonous bichloride of mercury. Other methods noted are charring and quickly covering with heavy tar, asphalt or pitch. The author notes that the actual healing of a wound may be more rapid if no such waterproof covering is used, but this rapid healing is of secondary importance compared with that of preventing the entrance of decay-producing organisms. *Cavity work*. Here the essential is the removal of all tainted wood. All parts of the cavity should be shaped so that water cannot lie in any place. Undercutting may often be necessary to hold the proposed filling better in place. Excavation must be followed by immediate shellacking of the edges and sterilizing of the rest of the cavity by creosote. Filling is often unnecessary. Bolts may be used to hold the sides together. Sheet tin, zinc, copper, iron may be used to cover such cavities, in which case a narrow half-inch ledge of wood should be left round the margin of the cavity from which the bark is removed, and to this the edge of the covering can be tacked. If it is decided to fill the cavity, it will be to prevent the new growth of wood and bark from rolling or curving into the cavity and to help this new growth to reach across the cavity more quickly. Three methods of filling are described in detail. They are (1) with cement mixtures, especially for small globular cavities, (2) with asphalt mixtures, e.g. asphalt combined with coarse, dry hardwood sawdust, shavings, sand, asbestos, crushed shells etc., and (3) with wood strips or blocks. These can be trimmed roughly to fit into various parts of the cavity and painted with asphalt or tar to waterproof them before they are nailed into place. A final warning is given that the operation of cutting, disinfecting and possibly filling is not the end of the business. The tree will always need careful watching thereafter and quick action if decay again sets in.

29.

CROCE, F. M.

634.37-1.55

Cosecha de los higos. (**Harvesting figs.**)

Rev. B.A.P., 1935, 18 : 207 : 13-8.

It is important for a number of reasons which are stated that the fig, whether for eating fresh, drying or preserving in syrup, should be picked at the moment of full maturity when its sugar content is highest, especially as it is a fruit which ceases to ripen further when detached from the tree. Maturity can be ascertained empirically by the appearance of the fruit, but chemical or densimetric tests are advisable. A simple way of performing the latter is described. An ancient method of hastening the ripening of the fruit which is still practised in fig-growing countries is to insert on the end of a bodkin or straw a drop of pure olive oil into the eye of the fig, 15-17 days before its normal ripening. The time of applying the oil is of particular importance, since if it is done too soon the fruit not only fails to ripen but dries up and drops off the tree. This operation will hasten the ripening of the fruit by 9-10 days, and it is stated that not only is the quality of the fruit improved but that the seeds are smaller. The reason for this acceleration of maturity is obscure and has been variously ascribed to the expulsion of air by the oil or to the effect of the puncture. The correct moment for gathering figs to be eaten fresh depends on the distance they have to travel. In general they should have begun to soften and should have taken on the typical coloration of the variety. Figs may be picked for drying (a) when

they show a slight corrugation and hang perpendicularly from the branches, (b) when, in the case of certain varieties, small fissures or white depressions develop in the neighbourhood of the neck, (c) when, in other varieties, a drop of clear syrupy fluid appears at the eye. Smyrna figs are allowed to fall naturally from the trees, which they do as soon as ripe. If picked the quality is inferior. Figs for preserving in syrup should be picked when mature and well developed but before they have begun to turn colour as the fruit must be sufficiently firm not to break down under the sterilization process. It is so important to get the fig at the right moment that the trees should be picked over daily. Fruit suffering from sun scald is discarded, being fibrous and unable to absorb the syrup. Fruit for jamming is picked when mature but before turning colour. In all cases the pickers should wear cotton or rubber gloves both to protect their hands from the caustic juice secreted by the fig and to reduce the chance of injury to the fruit by finger nails. If no gloves are used the hands should be frequently washed in vinegar. A portion of the peduncle should always be left on the fruit or decay will set in. Some varieties can be detached from the tree by hand alone but clippers or a knife are preferable. Picking should be done in the early morning as soon as the dew is off but before the fruit has been warmed by the sun and it should be packed or processed immediately. The number of pickings per tree depends on the variety and the weather, but usually it is not necessary to go over the tree more than three times.

The following also is noted :—

HARRIS, J. B. **Apricot pruning experiment at Light's Pass.** *Bull. Dep. Agric. S. Aust.*, 294, 1934, pp. 179-83.

SMALL FRUITS, VINES, NUTS.

30. LOREE, R. E. 634.711
Raspberry growing in Michigan.
Circ. Bull. Mich. agric. Exp. Sta., 152, 1934, pp. 39.

This bulletin contains the gist of various bulletins now out of print on the different aspects of raspberry growing in Michigan. It contains notes on varieties, diseases and pests and may be considered as a short manual on the subject.

31. JOHNSTON, S. 634.737
The cultivation of the high bush blueberry.
Spec. Bull. Mich. agric. Exp. Sta., 252, 1934, pp. 52, bibl. 14.

The commercial cultivation of the high bush blueberry (*Vaccinium corymbosum*) in Michigan is described. The development of the cultivated blueberry has been retarded by difficulties of propagation but these have now been overcome to a considerable extent. A considerable portion of this bulletin is devoted to the subject. German peat is still the most successful rooting medium for cuttings by means of which most of the propagating is done. This peat is an almost sterile, pure sphagnum moss peat free from weed seeds, and will hold large quantities of water without becoming waterlogged. It is thus superior to American peats which are weedy and waterlog easily. The most satisfactory type of cuttings is of hardwood of the previous season. The cuttings can be taken during the winter and stored in sand for planting in March. They produce good plants in two years. The peat in which the cuttings are set must not be pressed round them and must be kept moist. Glass propagating frames and burlap shades are necessary. Soft wood cuttings of the current season's growth can be used best when the secondary growth appears on the new shoots in July. A method known as tubering consists in laying short lengths of old wood $\frac{1}{4}$ -1 in. in diameter in German peat to a depth of 1 inch. Adventitious buds are produced which develop into shoots and these take root. The old piece of wood keeps the shoots alive till they become established. The method is less satisfactory than cuttings, but can be used as an additional source of material when the plants are old enough to require pruning.

32. DARROW, G. M., AND WALDO, G. F. 634.75 : 581.143.26.03
Responses of strawberry varieties and species to duration of the daily light period.

Tech. Bull. U.S. Dep. Agric., 453, 1934, pp. 31, bibl. 16.

The authors are trying to find out why different varieties of strawberries succeed in different regions. The reason would appear to lie in the varying light requirements of the varieties in question. Experiments on shortening the daily light period in summer and on lengthening it in winter are described, and the response of species types and of cultivated varieties as well as the relation of photoperiodism to the rest period in the strawberry are discussed. Among a few of the conclusions to which their results lead are the following:—Everbearing varieties are "long day" plants, whereas ordinary varieties are "short day" plants rarely forming fruit buds under natural conditions except in the autumn, when the days shorten and the temperature drops low. Daily light periods of 8, 10 and 12 hours in summer and early fall resulted in an increase in the number of blossoms produced the following spring. Varieties are considered to have characteristic temperature-day length responses which determine their regional adaptation. Southern varieties are grown under short day conditions at relatively low-growing temperatures and need little rest or no dormant period. Northern varieties grow very little under short day conditions, and, if first exposed to short daily light periods, need a low-temperature dormant period to break their rest period. The rest period in the strawberry is thought to be caused by a short-day low-temperature complex and is broken to some extent in some varieties by additional daily light exposures and in all varieties by temperature at or below freezing. The response of varieties to light conditions in October, November and December shows their regional adaptation. Varieties adapted to conditions in the southern States produce relatively long leaves with long petioles, while northern varieties grow little if at all during these months.

33. UPHOF, J. C. T. 634.75
 Die Kultur der Erdbeeren in den Subtropen. (Strawberry growing in the subtropics.)
Tropenpflanzer, 1934, 37 : 378-85.

The author describes briefly the systems of strawberry growing in Florida and under irrigation in the semi-arid, hot districts of the South-West, i.e. California, Arizona and New Mexico. He notes that the commonest species grown in North America is *Fragaria virginiana* Ducherne. In Florida Missionary and Brandy Wine are the most popular varieties. For growing under irrigation Klondike, Arizona, Brandy Wine, and to a small extent in Arizona St. Louis also, have proved most suitable. Strawberries are also grown in other more tropical parts as follows: In Cuba Lady Carneille, Aroma, Missionary, Klondike. In the Dutch East Indies European varieties are successfully grown both in the highlands at 3,000 ft. and over and also in the lowlands, provided protection against rain is given. Heyne states according to the author that the most successful varieties grown there are La Génèreuse and Non Plus Ultra.

34. FOTHERINGHAM, N. S. 634.8
 Results and particulars of various tests on vines carried out at Berri experimental farm.

Bull. Dep. Agric. S. Aust., 294, 1934, pp. 122-30.

A search for a variety superior to the Doradillo in this irrigation area in its cropping and sugar content has shown Trebbiano alone out of 12 varieties tested to be suitable. Trebbiano, moreover, does not hang on the vine so long as Doradillo. Fertilizer tests are in progress on Doradillo, Currant and Sultana grapes. Some 22 different treatments are being tried in addition to 4 tests of results from giving no fertilizer. The average crops for 8, 5 and 6 years of these three varieties respectively following the particular treatments are tabulated. No attempt is made to draw conclusions. The author notes that unfortunately the ground was previously under lucerne which so enriched it with nitrogen that even the no fertilizer plots showed good yields. In fact the only plots which did not show good returns were those on windswept patches of soil where

the lucerne had itself done badly. Ringing tests on currants show that a ring made with a double cut and the removal of a strip of bark $\frac{1}{8}$ in. wide results in greater yield than when only a single cut is made. The earlier the operation is performed, the better. With the sultana ringing and topping together are found to weaken the vitality considerably. As regards the best time and the width of the ringing tests were negative. Results of various methods of training are tabulated and discussed. They differ greatly for the three varieties tested, namely Muscat Gordo Blanco,* the Sultana and the Currant vine.

35. HUSFELD, B., AND SCHERZ, W. 634.8-1.541.11
Neuaufbau der Rebenunterlagenzüchtung. (Re-organization of breeding work
on vine rootstocks.)
Züchter, 1934, 6: 280-8, bibl. 8.

The author states the primary essentials of the ideal vine rootstock for German conditions to be that it shall be sufficiently resistant to the following:—*Phylloxera vastatrix* (in leaf and root), *Plasmopara viticola*, *Uncinula necator* and *Pseudopeziza tracheiphila*. Apart from this it should possess adequate suction pressure, good rooting (even under unfavourable conditions), upright healthy habit of growth, ease of vegetative reproduction, early and sufficient wood ripening, short internodes and high frost resistance. Finally it must unite well with the scion variety and ensure it a long and fruitful life. After discussing the essential steps to be taken to secure such paragons the writer stresses the necessity for finally testing all vines that have proved satisfactory in previous tests by planting them in *Phylloxera* infested vineyards under unfavourable soil conditions. Only after this test has been survived should their vegetative propagation on a large scale be undertaken with a view to distribution of material.

36. WANNER, E. 634.8: 581.162.3
Untersuchungen über die Keimfähigkeit des Pollens der Weinrebe (*Vitis*).
(Investigations on the germination capacity of vine pollen.)
Kühn Arch., 1934, 37: 317-65, bibl. 25.

The author summarizes as follows:—(1) The germination of vine pollen *in vitro* has been tested in 2,820 cultures, the observations being completed by artificial pollination and crop determination. (2) The nutrient medium used was sugar agar containing 2% agar and 10% saccharose (puriss.). Serious objections to the almost universal use of sugar solution as hanging drops are upheld. (3) A simple method of keeping the preparations is described. (4) Each test contains 10 preparations, in each preparation the germination of 1,000 pollen grains is noted and the length of the longest pollen tube at the time is determined on 10 occasions. In all some 2.5 million grains are counted. (5) The requisite number of repetitions and the number of grains to be counted in each preparation were determined on the basis of the probable error. Extraordinary variation was found to occur from time to time in germination per cent. (6) The germination capacity of *Vitis* pollen sinks rapidly after a few days, a fact which precludes the use of old pollen in vine pollination investigations. (7) Though exceptions are numerous, a certain parallel can be determined between germination percentage and length of pollen tube. (8) Abnormal pollen tube formation including twist and branching is common. (9) "Female" varieties show, generally speaking, only poor pollen germination capacity. The germination percentage varies so greatly in individuals of the same variety that it would appear impossible to group the common vine varieties according to the germination capacity of their pollens. (10) Enclosing the grapes from bud to blossom time has no effect on pollen germination capacity. (11) No effect of germination could be attributed to the influence of grafting or of particular rootstocks. (12) Ordinary artificial fertilizers are also found not to affect pollen germination. (13) No correlation was established between pollen germination and length of pollen tube on the one hand and crop on the other. (14) These investigations indicate that pollen germination tests are of extremely little use to practical viticulture.

* Produces leixas and table raisins.

37. ANTONIADES, P. 634.8-2.19
Apoplexy or vine stroke.
Cyprus agric. J., 1934, 29 : 110.

Apoplexy of the vine is brought on when the vine evaporates water at a quicker rate than it can be absorbed from the soil. This usually occurs when a hot dry summer follows cool and rainy weather or on land where the subsoil is damp in spring and the water table falls rapidly in early summer. The symptoms are a wilting of the tips of the shoots and leaves, the affected parts dying off. Sometimes the whole vine is killed. Vigorous vines having a greater evaporating surface suffer the most. No treatment is effective once the condition has appeared but subsoil drainage may act as a preventive. Plants which have been affected should have the dead wood removed during the winter.

38. BLACKMON, G. H., AND RUPRECHT, R. W. 634.521-1.8
Fertilizer experiments with pecans.
Bull. Fla. agric. Exp. Sta., 270 : 1934, pp. 48, bibl. 15.

The first experiments began in 1924 and consisted of a number of co-operative field experiments, the plots containing normally 4 or more trees each. Some 7 varieties of pecan were included. The fertilizer was applied once a year in February or March before bud growth was visible—except in one case where several applications were made—in circles more than embracing the spread of the branches. Different amounts of fertilizers were used in different orchards so that comparison of results is not particularly easy. Data presented show, however, that regardless of the fertilizer used 88 per cent of the treatments produced higher yields than where no applications were made. The benefit from the fertilizer proved greater in the case of heavy bearing varieties than in that of naturally light bearers and there is ample indication that the former type of tree growing on suitable soils should produce adequate yields, if complete fertilizer mixtures are applied annually. It is thought that on the heavier soils one application of fertilizer 2 to 3 weeks before the buds begin to burst in spring would suffice to give adequate growth and yield. Only in the case of a heavy set of nuts when moisture conditions are favourable, should this be followed by a 2nd application of ammonia in June or July, to ensure development of nuts and twig growth for production the following year. The fertilizer used should be a mixed one in which there would be approximately $\frac{1}{4}$ to $\frac{1}{2}$ inorganic and $\frac{3}{4}$ to $\frac{1}{2}$ organic ammonia sources and the P_2O_5 and K_2O derived from superphosphate and sulphate or muriate of potash. The actual amounts of the different elements would naturally depend on soil, cover crops and cultivation. Fertilizers did not materially affect the composition of the nuts.

39. WOODROOF, J. G. 634.521 : 581.144.2
Pecan root growth and development.
J. agric. Res., 1934, 49 : 511-30, bibl. 2.

The studies described here were made at the Georgia agricultural experiment station. Trees were dug, some to study the taproot, others to study laterals, others to examine the fibrous roots. Growth in the first few years has been described in a previous publication (*Bull. Ga. Expt. Sta.* 176, 1933, *H.A.* 1933, 3 : 4 : 483). It was found that vigorous spring growth of roots begins a little before that in shoots, roots being more sensitive to adverse and to favourable conditions of soil and weather. Great differences in length of taproot resulted from differences in soil and subsoil. Thus when the soil is loose, coarse, or poor in nutrients, or when the water table is low, pecan taproots have been found to penetrate down to a depth of 9 ft. or more. Roots in Georgian orchards rarely penetrate lower than 5 ft. There is a concentration of feeding roots near the surface of the soil. These are repeatedly killed by drought, frost and cultivation, but are quickly replaced under favourable conditions. Root pruning caused either by cultivation or by transplanting results in branching of the roots and may be an advantage. This is being investigated. Most small pecan roots are mycorrhizal. The anatomy of pecan roots is described, noticeable features including the absence of pith except from the taproot, the entire absence of root hairs, the absence of a distinct epidermis. Fertilizers can probably be applied with advantage in the fall provided erosion is prevented, since roots do continue to grow through

the winter. The author also notes the fact that the roots are almost completely inactive during droughts of several weeks' duration in the summer. At this time the nuts should be growing rapidly and the entire leaf area greatly needs moisture. Every method available should be used to satisfy this need.

40. CRANE, H. L., AND HARDY, M. B. 634.521-1.8-1.542
Interrelation between cultural treatment of pecan trees, the size and degree of filling of the nuts, the composition of kernels.
J. agric. Res., 1934, 40 : 643-61, bibl. 7.

The nuts studied were harvested in October and November, 1931, from 4 orchards, the trees from 2 orchards being of the Stuart variety planted in 1914 and 1915, those from the 3rd orchard planted in 1900 being Pabst, and those from the 4th Schley, planted in 1921. The growing season of 1931 was particularly dry and as a result the nuts generally were poorly filled. The following notes are from the authors' summary. Pruned trees were found to produce nuts with a higher specific gravity, heavier kernels and filled to a higher degree than nuts of the same size borne by similar, but unpruned trees. Under drought conditions the application of nitrogen decreased specific gravity, weight of kernel and degree of filling. It is found with pecans that a relatively high percentage oil content and a relatively low content of protein, carbohydrates, water and undetermined constituents are associated with a high degree of filling in nuts of otherwise comparable samples. Thus oil content or the degree of filling is of the greatest importance. Just as great differences may be found between comparable nut samples of the same variety grown under different conditions as between comparable nut samples from different varieties. The evidence indicates that these differences are caused by a limited supply of some essential element, probably nitrogen. The data indicate the danger of coming to erroneous conclusions if these are based on samples taken as an aliquot of the crop as a whole, since no account would thus be taken of the range of sizes and the degree of filling of the nuts in the sample. Hence the effect of a treatment on the nuts from experimental trees can probably be determined more accurately by measuring it according to the size and degree of filling of the nuts than by a chemical analysis of a representative sample.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

41. HARRIS, J. B. 634.1/8-2.111
Frost prevention by orchard heating.
Bull. Dep. Agric. S. Aust., 294, 1934, pp. 163-77.

An interesting account is given of attempts to obviate the results of the 2 or 3 nights' frosts, such as are liable to occur each spring between the hours of 2 a.m. and 6 a.m. in South Australian orchards, by means of heaters. The heaters which were used most successfully had the following dimensions†:—Diameter at bottom 7½ in., at top 9¼ in.; height 8½ in.; bodies 26 gauge black steel, top wired, bottom double seamed, spreaders 18 gauge black metal with welded arms; lids 26 gauge black steel with ¾ in. flanged rim. Torches‡ used were:—diameter 6 in., height 9 in., height to top of dome 10½ in., spout-diameter at union end ¾ in., at wick end ¾ in.—length of spout including union 13 in., content 1 gallon fuel. Shell "fuel" oil was found cheaper and just as long burning as shell "solar" oil and was used as fuel. Disaster occurred on one night as the result of the failure of the U tube alarm thermometer. Only after the event did the information from California come to hand§ that the U tube type of thermometer, reading maximum and minimum, is very unreliable for frost alarms. In order to be safe thermometers should be of the type that causes a bell to ring when the circuit is broken rather than when contact

* See also 113, 114, 150.

† *N.Z.J. Agric.*, August, 1928.

‡ *Bull. Univ. Calif.*, 398.

§ *Circ. Calif. agric. ext. Serv.* 40.

is made. Admittedly this may result in one or two false alarms, as it means the bell will sound if anything goes wrong with the line. A diagram and description is given of an ordinary thermometer fitted with electric terminals which should be suitable. Reckoning the cost of heaters at 1s. 9½d. each (in lots of 150 from Adelaide), life of heaters at 10 years, fuel at 5d. to 6½d. a gallon plus freight, the cost of heating 1 acre with 100 heaters will be:—1 heating of 4 hours—annual rental value of 100 heaters 18s., 100 gallons fuel oil at 6d., £2 10s.=total of £3 8s. If a second heating is necessary, the additional cost will be that of fuel, i.e. £2 10s., bringing the total for 2 nights to £5 18s. It is proposed to deal further with the economic aspect in a future article.

42. THOMAS, P. H.

634.11-2.111

Frost injury to apples.

Tasm. J. Agric., 1934, 5: 163-7.

The effects of a temperature 3° below freezing point on apples which were at the time ¾-1 in. in diameter with their calyces incompletely closed is described. The apples were kept under observation throughout the ensuing season. *Sturmer Pippin*. A large portion of the crop was affected. The apples were lopsided with constricted growth round the basin producing a furrowed effect. Fruits cut transversely showed brown necrotic areas which were confined to the core line on the injured side of the apple. The fruits were otherwise sound and kept for 6-8 weeks. *Cleopatra*. Injury here took a different form to that in other varieties. The skin surface was scored and pitted with a deep crinkle. The core line of the vascular bundles was injured, otherwise the flesh was sound. *Scarlet*. Only slight malformation was shown, the basins being wider and shallower than normal. Outwardly skin surface alone was injured and this took the form of raised, russeted scabs similar to injury by powdery mildew (*Podosphaera leucotricha* Sal). Within, the core line vascular bundles showed the characteristic injury. The affected fruit kept for 8 weeks in good condition. *Jonathan*. These were more advanced at the time of the frost and a higher percentage was rendered unmarketable. The whole basin was depressed and widened, the flesh injury being confined to the region around the basin; the necrotic areas were larger but similar to bitter pit lesions. The fruit kept for 8 weeks. The injuries differed so much between varieties that, had the cause not been already known, a number of different diagnoses might easily have been suggested.

43. COLLISON, R. C., AND HARLAN, J. D.

634.11-2.111

Winter injury of Baldwin apple trees and its relation to previous tree performance and nutritional treatment.

Bull. N.Y. St. agric. Exp. Sta., 647, 1934, pp. 13.

Observations on winter injury were made in the severe winter of 1933/34 on trees which for the past 4 years had been under fertilizer tests on an acid soil (see abstract 26 of this number). The observations were submitted to statistical examination. It was found that those fertilizers which carried nitrate nitrogen or furnished available lime not only resulted in higher yield and better growth but also reduced winter injury and best fortified the trees against low temperatures, regardless of the fact that the high yield of the previous year had a definite tendency to increase winter injury.

44. CARNE, W. M., AND MARTIN, D.

634.11-2.1: 664.85.11

Apple investigations in Tasmania. Miscellaneous notes.

J. Council. sci. industr. Res. Aust., 1934, 7: 203-14, bibl. 25.

(1) *The virus theory of bitter-pit*. The theory put forward by Atanasoff* that bitter pit is a virus disease is examined by the authors and considered to be unsound. The theory is founded mainly on selections from published data and many of the statements are, the authors note, contrary to their experience. Instances of this are given. Grafting experiments in Victoria and Tasmania are described with trees showing symptoms recognized by Atanasoff as bitter pit, in which the

* Summarized in Annotated bibliography on bitter pit. Imperial Bureau of Fruit Production, Occasional Paper No. 3, 1934.

results failed to justify the theory. The authors remark, however, that this does not mean that some of the many disorders which Atanasoff recognizes as bitter pit are not due to virus but that the theory cannot be applied to all of them. (2) *Crinkle in apples*. The object of this note is to prove that water-core is an essential step in the origin of crinkle, a view which does not appear to have received the attention of other workers. Four types of crinkle are described and evidence to show their association with water-core is produced. (3) *Water-core breakdown*. Evidence of the need of attention to water-core in the picking and inspection of apples for export is brought forward. Two main types of water-core are described, namely early or immaturity water-core, and radial, late or maturity water-core. There are three main types of consequent breakdown, one of which, called by the authors breakdown of the deep scald type, does not appear to have been previously described. In this type breakdown occurs some distance from the injected tissues, i.e. if the injected tissue is at the calyx end breakdown will start in the stem half. (4) *The correlation of refractive index and freezing point depression*. A rapid simple method of determining molecular concentration of apple juice in very small quantities has been devised by means of a close correlation which was found to exist between refractive index, molecular concentration and osmotic pressure. Refractive index was measured by means of a Zeiss dipping refractometer with an auxiliary prism and molecular concentration and osmotic pressure calculated from the depression of the freezing point determined by the Beckmann apparatus. It is hoped to employ this method to demonstrate differences in sap concentration and therefore the mechanism for possible osmotic gradients between apple tissues.

45. DU PLESSIS, S. J. 634.13-2.114 + 632.3
Excessive drop of Winter Nelis blossoms.
Fmg. S. Afr., 1935, 10 : 75.

Two types of blossom drop were discovered in the Somerset West and Ceres districts of S. Africa. The first, in which the calyces and rest of the blossom turn brown and yellow respectively before dropping was found to be due to lack of cross-pollination. Bon Chrétien proved the best pollinator with Louise Bonne and Beurré Bosc taking second place. The second type, in which the blossoms and in some cases their pedicels blacken before dropping was traced to *Bacterium nectarophilum*. This organism was found to be spread mainly through the agency of hive bees, wind and smaller insects playing a very minor part. The bacterium apparently overwinters in the fruit buds between the scales. The routine applications of lime sulphur and bordeaux mixture employed in the control of *Fusicladium* should be sufficient to control also bacterial blossom wilt.

46. DUNEGAN, J. C. 634.23-2.314
A disease of the English morello cherry caused by *Bacterium Pruni*.
J. agr. Res., 1934, 49 : 745-54, bibl. 11.

The difficulty is stressed of distinguishing the effects of *B. Pruni* from those of the leaf spot fungus, *Coccomyces hiemalis*, on the upper surface of cherry leaves. There is no such difficulty as regards the undersides, where the bacterial lesions stand out as dark-brown, water soaked spots, while the fungus lesions are brownish grey and are often covered with white masses of spores. It is found on leaves, twigs and fruit and its symptoms on these are described in detail. In some seasons such distortion may be caused in the shape of the mature cherries as to cause a reduction in saleable crop. The effect of injury to leaves and twigs is indirect.

47. RUDLOFF, C. F., AND SCHMIDT, M. 632.42 : 634.11-1.523
Venturia inaequalis (Cooke) Aderh. II. Zur Züchtung schorfwiderstandsfähiger Apfelsorten. (**Breeding scab-resistant apple varieties.**)
Züchter, 1934, 6 : 288-94, bibl. 8.

The authors describe observations made on the scab resistance of various apple varieties and *Malus* species both in the open and when submitted to artificial infection in 1933 and 1934. Some of the *Malus* species are found to be particularly resistant especially those furthest removed

from commercial varieties in size and taste of fruit. These have already been crossed with commercial varieties and the resulting seedlings are being tested. One year's observations in 1934 show that whereas only 3.1% of the descendants of commercial varieties show immunity, some 26.8 of species seedlings and species \times commercial variety crosses show immunity. So far these crosses have given only very small fruits, but crosses of Gelbe Bellefleur with *M. Zumi* show that the size of the fruit in such crosses may be greater than that of the wild parents, and it would appear possible that some of the resistant crosses may show this phenomenon. If not, back crosses of these F1 seedlings with the large fruited varieties will have to be made. The authors utter a word of warning as to the multiplicity of forms found in the fungus, a fact which may complicate the resistance problem (see *H.A.*, 1935, 5 : 1 : 48).

48. RUDLOFF, C. F. 632.42 : 634.11
Venturia inaequalis (Cooke) Aderhold. III. Zur Formenmannigfaltigkeit
 des Pilzes. (The apple scab fungus. III. Its multiplicity of form.)
Gartenbauwiss., 1934, 9 : 105-19, bibl. 7.

In the summer of 1933 spores of the fungus were collected from different apple varieties in different parts of Germany and Switzerland. A single spore (conidia) culture was made from each under identical conditions. Whole cultures were later inoculated on to identical media (Pulstagar), and after waiting 31 days the morphological characters were examined macro- and microscopically. Spores from 172 sources were so treated. The result was astonishing. The multiplicity of forms was so pronounced that no two cultures behaved in exactly the same way. Differences appeared in form and strength of growth, colour of the mycelium on the medium and of aerial mycelium, in structure of the aerial mycelium, in the form of the hyphae and in formation of conidia. The particular differences are described in detail with the help of microphotographs. The differences observed generally speaking remained intact after passage through different nutrient media. Certain sources such as Zuccalmaglio gave types of fungi having a definite tendency to vegetative mutation.

49. KENT, W. G. 634.11-2.95
 A commercial apple-spraying demonstration in 1933.
J. Minist. Agric. London, 1934, 49 : 733-42.

The plot consisted of 6½ acres of large Bramley's Seedling trees. Three different brands of mixed tar-petroleum washes were used. Great differences in ease of handling occurred and are discussed. Apple capsid and rosy apple aphid were satisfactorily controlled by all of them. Observations are made on the development of apple scab and on bordeaux injury. The materials, labour and time required are tabulated and costed and the operations are found to be more economical than those of ordinary commercial practice. Satisfactory control of scab was obtained both by bordeaux and by lime sulphur. Bordeaux gave cleaner fruit than lime sulphur, but observations on injury caused suggest that the use of large capacity nozzles for bordeaux at normal strength involves excessive risk of leaf damage, even on such varieties as Bramley's Seedling.

50. TURNBULL, J. 632.94 : 634.1/7
 Fruit tree spraying equipment.
Sci. Hort., 1935, 3 : 24-32.

This is a paper given before the Horticultural Education Association together with the salient points of the discussion which followed. *Spraying outfit*. The author utters a warning against calculating pump output on an hourly basis. It must be remembered that about 1½ hours are needed for starting up in the morning and for clearing up at night, moreover, if men move their own pipes or wait while the outfit is taken away for refilling, spraying will stop for 2½ to 3 hours. This leaves only 5 to 6 hours for actual spraying in a 9½ hour day. Experience with existing

types of spray nozzles shows that the very high pressure of 400 lb. per square inch is justified by the saving in time and material. It is essential that all parts of the machinery should be kept clean and in repair in order to stand up to the work. *Systems of spraying.* Mechanical spraying with hop washers, the mobile system, the headland system and the central spraying system are discussed in turn, and it is considered that the control pumping plant with underground mains and laterals is the most efficient system for established trees. A complete small plant for 10 acres could be installed for an outlay of £100 plus the cost of labour for trenching in pipes and fitting up the pump house. *Spray nozzles, lances and guns.* With reference to the long accepted idea that the production of a fine mist is essential the author's opinion is "there is nothing good that can be said of a mist . . . under farm conditions, and the sooner it is abandoned the better". He considers that the essential is a spray, with long carry, reasonable width and even distribution. As between spray lances and spray guns there is no essential difference except that when working the lance has a fixed and the gun a variable-spray. A gun is in fact a lance and nozzle with the addition of mechanism for altering the spray when in use. "Adjustable nozzles and guns may be satisfactory in the hands of experts, but they are perfectly useless for ordinary farm labour. . . . What is wanted for farm use is a short lance with a fixed spray." The author has himself evolved a type of fixed double nozzle, which produces the right type of spray and has been proved under farm conditions. The same spray does for any size of apple tree by using 2 ft. or 4 ft. or 6 ft. lances as may be necessary. It does not demand more than 250 lb. pressure except for very tall trees. Single nozzles are more satisfactory for low pressure work. The size of disc is all important and must be varied to suit circumstances. Briefly small trees, light sprays, high pressure, double nozzles, unskilled labour and good weather conditions call for smaller discs, while opposite conditions demand larger discs. In the discussion which followed the spray gun combined with expert labour found support in certain quarters, Davies of Wye in particular suggesting that the gun especially gives great hope of improvement in spraying technique. Improvement in gun design may be hoped for.

51. CARROLL, J. 634.1/7-2.951.4
Development of an improved type of winter spray for orchards.
J. Dep. Agric. Saorstát Éireann, 1935, 33: 48-52.

An improved type of winter spray "Super Killova" has been developed and put on the market. It is composed of 50% tar distillate and 25% light mineral lubricating oil together with the necessary emulsifying ingredients. Detailed laboratory and orchard tests have shown at 8% concentration a practically complete kill of aphid, apple sucker and red mite eggs without injury to dormant buds of apples and bush fruits. It is not yet known whether it gives a better kill than ordinary tar distillates of other eggs such as winter moth and capsid or whether it gives a better control of woolly aphid and other living insects, but the probability is that it does. It is definitely recommended by the author as a winter spray instead of one of the tar distillates, in all cases where red mite (red spider) occurs.

52. TURNBULL, J. 632.94: 634.1/7
New type of spray for fruit trees.
J. Minist. Agric. London, 1934, 49: 433-5.

A new type of general purpose spray is described and illustrated. The 2-nozzle spray starts to widen at less than a foot from the nozzle, quickly attains a width of 2 ft. and maintains that width throughout its length. With a good 4-h.p. engine working at a pressure of 250 lb. per sq. in. the effective carry is 15 ft. This has been tried successfully on all kinds of tree from 10 to 30 ft. high. Thanks to the use of 6 ft. lances the tops of the trees were sprayed satisfactorily at 250 lb. pressure. The tallest apple tree can be sprayed using these lances at a pressure of 400 lb. For trees up to 18 ft. a 2 ft. lance is better. Notes are given on the right size of disc to be used. These should vary according to size of tree, pressure, and weight of spray required. The actual details of construction are given.

53. BORDEN, A. D. 632.951.8
The tank-mixture method for dormant oil spraying of deciduous fruit trees in California.

Bull. Calif. agric. Exp. Sta., 579, 1934, pp. 20.

A plea for the tank-mixture method of dormant spraying with instructions for mixing, agitating and equipment required. It is claimed that a great saving in expenditure can be made by buying the spreader and spray oil and adding them separately to the water in the spray tank, where a uniform mixture is produced and maintained by agitators, instead of buying the emulsion in paste form and adding this to the water in the spray tank. One part of powdered blood albumin of a definite high solubility + 3 parts of a suitable diatomaceous or finely ground earth, used at the rate of 4 oz. to 100 galls. spray, is found to be very satisfactory and superior to calcium caseinate as a spreader. Flat, square-ended agitators made of $\frac{3}{16}$ in. mild steel from 2 in. and 3 in. band material are found to be the most efficacious. Details of choosing size, fitting and using these agitators are presented. Notes are given of the successful use of the tank-mixture method in 1933 in different parts of California. Based on these tests doses are suggested suitable for use against San José scale, brown apricot scale, fruit tree leaf roller egg masses, brown mite eggs.

54. CRESSMAN, A. W., AND DAWSEY, L. H. 632.951.8
Oil retention, oil emulsifier ratio, and oil-water ratio as affecting the insecticidal efficiency of emulsions.

J. agric. Res., 1934, 49 : 1-19, bibl. 14.

The tests were made on the camphor scale, *Pseudaulnobia duplex* (Ckll), living on the camphor plant with a number of emulsions made with mineral oil. Insecticidal efficiency was found to depend principally on two factors, viz. population density and oil retention. Heavily infested plant areas showed lower mortality than sparsely infested twigs for equivalent quantities of oil. Susceptibility to the oil in the adult stage decreased with increased age of scales. The greater the oil deposited per unit area of plant surface, the greater was the insecticidal efficiency. Oil deposit varied inversely with the concentration of soap emulsifier in the aqueous phase of the emulsions, but varied directly with the concentration of oil in the emulsions. Hence insecticidal efficiency can be increased within limits by using less emulsifier or by increasing the oil concentration.

55. MARTIN, J. T., AND TATTERSFIELD, F. 632.951.1
The effect of environmental conditions upon pyrethrum (*Chrysanthemum cinerariaefolium*) I and II.

Ann. app. Biol., 1934, 21 : 670-81, bibl. 9, and 21 : 682-90, bibl. 3.

The experiments described here were made at Rothamsted on clonal plants in pots. It was found that on heavy soil of low fertility, i.e. that used in the work, the pyrethrin I content of the flowers was not increased by the application of fertilizers. The plants produced good yields of flowers rich in pyrethrins irrespective of fertilizers. The extent of production of pyrethrin was characteristic of the individual plant and was dependent on some factor which was apparently genetical. Plants derived from rooted shoots produced flowers of the same quality as regards pyrethrin content as those yielded by the original plant. Selection followed by vegetative propagation can, therefore, improve insecticidal properties. Most of the pyrethrin found in the flowers was located in the ovaries. In the second experiment weather conditions were found to influence flower formation and pyrethrin content. Thus partial shading during 5 months preceding flowering resulted in the production of smaller flowers with a reduced pyrethrin content. The successful flowering was largely dependent on the relative temperatures experienced during the year. A dormant period, dependent upon sufficiently low winter temperatures, i.e. normal English outdoor conditions (as against 59°-77° F. in glasshouse), was shown to be necessary for the normal production of a large number of flowers.

56. TATTERSFIELD, F., AND MARTIN, J. T. 632.951.1
The loss of activity of pyrethrum. II.
J. agric. Sci., 1934, 24 : 598-626, bibl. 10.

It was found that the pyrethrin I value as determined by the acid method, subject to a small correction, gave a good indication of the relative activity of pyrethrum samples. Exposure of pyrethrum flowers, whole, and finely and coarsely ground, to sunlight and air resulted in a relatively rapid loss of pyrethrin I. Stored in covered trays or tins the loss was much slower. The loss was not so great from the whole heads. The addition of antioxidants such as tannic acid and hydroquinone did not augment the initial insecticidal activity but did tend to stabilize the activity in a talc pyrethrum dust. [From authors' summary.]

57. ADRIANO, F. T. 632.951.1 : 581.192
A preliminary study on the rotenone content of some derris roots collected from different parts of the Philippines.
Philipp. J. Agric., 1934, 5 : 245-54, bibl. 11.

Derris plants, the majority growing wild, were collected from various districts in the Philippines and subjected to analysis for rotenone content. The plants were sent in under native names which differ with the locality in many instances. No indication is given whether one or a number of species are covered by these names. Results are tabulated according to district. As a general summary it may be said that, while all Philippine derris samples contain rotenone, there is a considerable variation in the percentage, which in this paper has been correlated with the district from which the sample was obtained. Thus two districts furnish a high yielding sample, 24.2 and 16.9 kg. per ton, while eleven other districts average respectively from 8.5-0.43 kg. per ton. The reports of other workers that small roots, at most 1 cm. in diameter, contain a greater quantity of the active principle than bigger roots is confirmed.

58. CAHN, R. S., AND BOAM, J. J. 632.951.1 : 581.192
Determination of rotenone in derris root and resin.
J. Soc. chem. Ind. Lond., 1935, 54 : 37T-42T, bibl. in text 13.

H. A. Jones' method is critically reviewed and defects are pointed out. The influence upon the results of such factors as the proportion of solvent to resin and the amount of solvent used for washing the rotenone-carbon tetrachloride complex is discussed. The substitution of trichloroethylene for carbon tetrachloride as solvent in extracting roots is suggested on the grounds of more rapid completion of extraction and the greater stability of rotenone in the former solvent. A method is given for determining the purity of the rotenone-carbon tetrachloride complex by treating with alcohol and weighing the liberated rotenone. The results so obtained are compared with those obtained by determination of methoxyl and of chlorine and by measurement of optical rotatory power. In all the examples quoted, the "alcohol recovery" method gave results somewhat lower than by the other methods. It is shown next that certain types of roots and resins, which, when examined by the present standard methods of analysis, appear to contain no rotenone, may actually contain a considerable amount. This "hidden" rotenone can be determined by the addition of a large amount of rotenone complex to the carbon tetrachloride solution of the resin instead of merely seeding, as is usual. The excess of rotenone recovered is taken to be the amount present in the roots. Full practical details are given of a revised method for rotenone determination. H.S.

59. CAHN, R. S., AND BOAM, J. J. 632.951.1 : 581.192
The constituents of derris resin.
J. Soc. chem. Ind. Lond., 1935, 54 : 42T-45T, bibl. 22.

From the results of other workers it appears that rotenone occurs as such in derris root. It is almost equally certain that toxicarol, deguelin and tephrosin do not occur to any considerable extent, despite frequent references to them as "constituents" of derris resin. In the present paper fresh evidence is presented to show that toxicarol does not occur as such in derris resins. From a "Sumatra-type" resin, i.e. a resin of low rotenone content, a new substance has been

obtained. From the very mild conditions of its isolation, it appears that this is a true constituent of the resin. This substance, formula $C_{23}H_{22}O_7$, is a colourless, dimorphic, phenolic body, m.p. 189° and 192-194°. In the form of a highly concentrated dust it is toxic to winter moth caterpillar, but this fact is probably of little practical significance since the material is present only in small amount in the resin. It is pointed out that the toxicity to fishes of any material is no indication of its insecticidal value, since there is a complete absence of any correlation of the two. Because the toxicity to insects of toxicarol, deguelin and tephrosin is very considerably less than that of rotenone, it has often been assumed that rotenone content is a fair indication of the insecticidal value of a derris product. The authors claim that this assumption is unjustified since nothing is known of the nature or toxicity of the other constituents in the form in which they occur in the root or resin. H.S.

60. ESSIG, E. O., AND HOSKINS, W. M. 632.6/7

Insects and other pests attacking agricultural crops.

Circ. Calif. agric. Ext. Serv., **87**, 1934, pp. 155.

Californian pests and their suggested control are dealt with under the particular plant attacked. Cross indexing is adequate and an index at the end makes reference easy. Rodents are not included in this circular, but all other common pests on deciduous and citrus fruit trees will be found here.

61. GLASGOW, H. 634.13-2.76

The feeding habits of the sinuate pear borer (*Agilus sinuatus*) in relation to control practices.

Bull. N.Y. St. agric. Exp. Sta., **648**, 1934, pp. 31.

The adult beetles are found to feed freely on pear foliage. Orchard tests indicate that the females can be killed and the pest thereby controlled if two applications are made of a lead arsenate spray at 4 to 5 lb. in 100 gallons water. The first should be made just before the peak of the adult emergence and the second about a fortnight later.

62. STANILAND, L. N. 634.714-2.77

The loganberry cane maggot.

J. Minist. Agric. London, 1934, **41** : 151-3, bibl. 5.

An attack of the raspberry cane maggot (*Phorbia rubivora* Coq), a serious pest in Canada and U.S.A., on loganberries in South Devon in 1933 is described. The adult flies appear in April and lay their eggs on the tops of young canes of raspberries, loganberries and blackberries. The maggots burrow into the cane, tunnel downwards for a short time and then girdle the shoot, thus causing wilting. The maggots then proceed downwards through the cane to the base near the ground, in which situation they pupate, remaining in the shoot till the following spring. The fly has occasionally been previously recorded in England but does not appear to make headway. Control would consist in cutting out and burning affected shoots; the cut should be made well below the wilting point and should be repeated lower down if necessary till all signs of tunnelling have disappeared.

63. HEY, G. L., AND THOMAS, F. J. D. 633.78

On the biology of some *Tortricidae* (*Lepidoptera*) infesting fruit trees in Britain. I. *Cacoecia* (*tortrix*) *podana* Scop.

J. Pomol., 1934, **12** : 293-310, bibl. 42.

C. podana would appear at present to be one of the commonest and most serious tortrix pests of south-eastern and probably the rest of England. It occurs on fruit and other trees and on vines in greenhouses. The larvae feed inside the opening buds, leaves and blossoms in spring and prevent their proper development, and in autumn they have lately been found to do considerably more serious damage to the fruit surfaces of apples, pears and sometimes damsons. This damage may continue in the packing shed and in store. No particular control measures are universally successful. They include 10% tar distillate winter spraying, arsenate of lead spring

spraying, light traps for the moths, and for fruit in store the use of certain gas mixtures. The parasitism of the moth is also being studied. An account is given here of the life history and habits of the moth and of its eggs and egg laying while the morphology (excluding chaetotaxy) and biology of the larva and pupa are described.

The following are also noted :—

SMITH, C. O. Inoculations showing the wide host range of *Botryosphaeria Ribis*. *J. agric. Res.*, 1934, 49 : 467-76, bibl. 23.

YOUNG, P. A. Penetration, distribution and effect of petroleum oils in apple. *J. agric. Res.*, 1934, 49 : 559-71, bibl. 18.

TATTERSFIELD, F. An apparatus for testing contact insecticides. *Ann. appl. Biol.*, 1934, 21 : 691-703, bibl. 2.

BOVINGDON, H. H. S. An improved laboratory apparatus for fumigation experiments. *Ann. appl. Biol.*, 1934, 21 : 704-24, bibl. 26.

LAL, K. B. *Psyllia peregrina* Först., the hawthorn race of the apple sucker *P. Mali* Schmidb. *Ann. appl. Biol.*, 1934, 21 : 641-8, bibl. 9.

VEGETABLE GROWING.

64. WRIGHT, S. J.
Machinery in vegetable production.
Sci. Hort., 1934, 8 : 97-108.

635.1/7-1.51

The use of machinery in vegetable growing is being extended rapidly in market gardening proper for speeding up the more urgent operations, e.g. that of preparing a new seed bed quickly after removal of a crop, and in vegetable growing on the general farm in place of root crops, where the special problem is to adapt tractors to inter-row cultivations. *Tractor hoeing*. This with a two man outfit is simply an adaptation of the ordinary steerage horse hoe. There are several forms of this equipment and it presents no particular difficulty. With a one man outfit, on the other hand, the big basic difficulty is that if the hoes are fitted at the rear they will tend first to move in the opposite direction to that in which the machine is being steered, and though it is not impossible to fit them in front, this necessitates somewhat complicated machinery. The difficulty of fitting to the front has been solved for track laying but not as yet for wheeled tractors. The great disadvantage of all ordinary forms of mechanical hoe equipment is that they cannot be used for inter-plant cultivation. To get over this the so-called "selective hoe" has been devised. It is here described. The actual hoes are so hinged to a light frame that pressure on a hand lever causes the blades to open when required and to clear the plants. It was originally designed for young strawberry rows and has been found particularly useful on land which will set if not completely broken early in the season. There still exists an excessive gap between the market garden cultivator and the small tractor from the point of view of power, price and capacity for control. A few notes are given on existing tractors which are found useful in hop gardens, and in fruit plantations. They include a conversion of an old Morris car, a track laying tractor called the Bristol, a new crawler attachment for the Fordson and the Trojan low powered wheel tractor. The difficulty is often slight or non-existent in the rows themselves, but it is the length over all which makes turning at the ends a problem. The author notes that there should shortly be on the market a new light weight tractor together with a complete and interchangeable range of directly attached implements including plough bodies, cultivators and harrows, all for use with a very convenient hydraulic lifting device. Its performance under demonstration conditions was very good. *Rotary tillers*. The combination in one machine of cultivator and rotary tiller offers a great saving in capital expenditure and has already been done in the Coleby cultivator, which is, however, rather small for general application. Mention is also made of a large gyrotiller suitable for contract work, which has been successful where used. Other machines noted with approval are a transplanter and a brussels sprout washer.

65. SECRETT, F. A. 635.1/7-1.67
Irrigation of vegetable crops.
Sci. Hort., 1935, 3 : 82-96.

The author's first advice is never to irrigate unless obliged to do so for the welfare of crops, so great is the after care necessary in dealing with acidity and other adverse effects in the soil. The initial cost is heavy, labour costs also increase and the manure bill goes up by leaps and bounds. The paper is essentially of a practical nature based on large scale practical experience, and among the points dealt with are the following :—preparation of land with special reference to light sandy soil, sowing immediately after irrigation, irrigating growing crops, possible use of fertilizers in irrigation water, growth under irrigation of lettuce, cauliflowers and other crops of the cabbage family. Details are given of the author's own overhead irrigation equipment. He recommends that mains should be laid so that spraying lines are about 200 ft. long and in no case longer than 300 ft. The valves should be 40 ft. apart in the mains and from them connexion is made to the spraying lines with armoured hose. The planting of lilac hedges when putting in the pipe lines provides a good wind filter. The actual layout of the spray lines with suggestions for improvement, and such refinements as aerating and adding fertilizer to the irrigation water are also described. A specification of the irrigation plant is given and finally a few notes are made on irrigation of narcissi, cooling bulbs for forcing, and irrigation under glass.

66. RUDOLF, W., AND STELZNER, G. 635.52 : 581.143.26.03
 Untersuchungen über lichtperiodische und Temperaturnachwirkung bei
 Sorten von Salat u. die Möglichkeit ihrer Ausnutzung im Gemüsebau. (**Effect
 of light and temperature changes on lettuce and the possibility of utilizing
 these effects.**)
Gartenbauwiss., 1934, 9 : 142-53, bibl. 9.

The experiments on varying the period of light were made for about 12 or 24 days on different varieties of lettuce during the seedling stage. The normal daylight at the time of the experiment being about 16 hours, trial was made of restricting it to 12 to 8 hours daily. Results varied considerably with the varieties according to whether they were essentially long or short day plants. In certain varieties restricting daylight to 12 or 8 hours a day had the effect of inhibiting any tendency to flower and seed production. In some restriction to a 12 hour day not only had this effect, but also encouraged head formation. It is thought that by using a treatment suitable for the type concerned it may be possible to check any tendency to shoot and also to regulate better the time when plants will be ready to market, as well as to produce better sized heads. The effect of temperatures was also tried. In the latter treatment germination took place on June 28th. From June 30th when the average root length was 0.5 cm. these seedlings were exposed to darkness and to temperatures of 5° C. and -5° C. until July 10th. From July 10th till July 24th they were in frames, after which they were planted out. They were harvested on October 5th. Exposure to -5° C. resulted in much less shooting and in considerably better heads.

67. RAMALEY, F. 581.14 : 612.014.44
Influence of supplemental light on blooming.
Bot. Gaz., 1934, 96 : 165-74, bibl. 3.

(1) The effect of additional day length produced by artificial illumination during the winter months upon 100 species of greenhouse-grown (chiefly annual) plants is reported. (2) In practically all cases the experimental plants were taller, somewhat paler, less sturdy, and had a poorer root system than the controls. (3) The time from planting to blooming was shortened in 41 species, not greatly affected in 27 species, and lengthened in 12 species. (4) Of the plants hastened in blooming by supplemental light, most are natives of the temperate zone while those which showed no response were largely tropical. A few perennials were brought into blossom during the first season. [Author's summary.] For further references to the subject the reader is referred by the author to Ramaley's "A working bibliography of day length and artificial illumination as affecting growth of seed plants." *Univ. Colorado Studies*, 20 : 257-63, 1933.

68. CONSTANTIN, J., AND MIÈGE, E. 633.491
 Stimulation par une culture dans l'Atlas de pommes de terre cultivées ensuite
 à Rabat. (Re-energizing potatoes for subsequent growth in Rabat by a
 season's cultivation in the Atlas.)
Rev. Bot. appl., 1935, 15: 17-20, bibl. 3.

Potatoes (variety unknown) from plants grown in the lowlands of Morocco were planted for one season in the Atlas mountains at about 3,200 feet. The following season tubers from this crop were planted at Rabat in the lowlands and produced a crop about 3 times as large as the controls which had remained at Rabat throughout.

69. KENDRICK, J. B. 635.13-2.314
 Bacterial blight of carrot.
J. agric. Res., 1934, 49: 493-510, bibl. 11.

The organism causing this disease, apparently an undescribed species, is named by the author *Pseudomonas Carotae* n.sp. Its most serious damage in the seed producing area of the Sacramento valley, California, lies in the destruction of the seed umbels with consequent reduction in seed yield. The author describes the isolation, culture and re-inoculation of the organism and its effects on the plant. Observational evidence suggested both seed and soil as possible sources of infection, but experiments to determine the responsibility of seed have been as yet negative or inconclusive.

70. LEWIS, E. P. 635.31-1.55
 Asparagus yields as affected by severity of cutting.
Bull. Ill. agric. Exp. Sta., 401, 1934, pp. 27-36.

The tests were made at the Cook County Experiment Station, Des Plaines. Crowns of the Mary Washington variety were grown during 1925 and set in permanent beds in the spring of 1926. There were 18 plots each consisting of a single row 375 feet long with 150 crowns. Rows were 4 feet apart and the crowns were spaced at intervals of 2½ feet. Depth of planting was 8 inches. No fertilizer was given in the first year. Thereafter the plots were discd in autumn and 500 lb. of 4-8-4 fertilizer applied at the end of the cutting season. A cover crop of oats was sown each year about August 1st. Six different degrees of cutting were made in triplicate. The results were recorded over a period of seven years. Cutting in the first year after setting was found to be detrimental. Thus the plot which was cut for only 2 weeks in the first year gave lower total yields for the 7 year period than plots which were not cut until the 2nd or 3rd year. No cutting the first year, light second year cutting, i.e. for say 2 weeks, and medium cutting the third year resulted in the highest yield and quality over the 7 year period. If a plantation has made very poor growth it may be advisable to delay cutting till the 3rd year.

71. MORRISON, G., AND OTHERS. 635.34
 Cabbage varieties.
Spec. Bull. Mich. agric. Exp. Sta., 249, 1934, pp. 68, bibl. 66.

The history of the cabbage is traced from the earliest times. A general description of the plant is given with a short account of recent breeding studies. The origin and development of cabbage varieties is discussed. One hundred and ten varieties are described and their synonyms, which seem to be innumerable, are given. A variety index of about 500 names facilitates reference.

72. PRESTON, N. C. 635.35-2.42
 The control of club root (finger and toe) in cauliflowers.
J. Minist. Agric. London, 1934, 41: 329-35.

As a result of co-operative trials by advisory mycologists in England and Wales it has been found that cauliflower seedlings free from club root (*Plasmodiophora Brassicae*) will produce a satisfactory crop (i.e. over 70% marketable) on soils heavily contaminated with club root, if a 0.05% solution of corrosive sublimate (1 oz.-12½ galls. water) is applied to the seedlings at planting out. The method of application is to pour ½ pint of the solution into each hole before inserting the plant.

73. CALDWELL, J. 635.64-2.8
The control of virus diseases of the tomato.
J. Minist. Agric. London, 1934, 41 : 743-9.

The following diseases are discussed :—Mosaic, streak, spotted wilt, aucuba mosaic and "double virus" streak. Notes are given on the general properties of viruses. All appear to have this in common that they can develop only in living tissue and can enter a healthy plant only through a wound. After noting the danger of infection by insect vectors or weeds the author recommends the following control measures :—removal of weeds from vicinity of house irrespective of whether they appear to be infected or not ; smoking tobacco has been known in America to carry infection of the tobacco mosaic and is very probably a source of infection to tomatoes in this country, hence smoking should be prohibited or the tobacco should be rendered innocuous by heating in some form of container to 100° C. for a minute or two before use ; plants should be carefully examined before tying or stopping each year and all discarded that are at all suspect ; routine fumigation and clearing out corners and crannies should dispose of all possible insect vectors. Where any material that can possibly be suspect of harbouring a virus has been handled, it is essential that the operator should wash his hands in ordinary soap and water before touching any of the stock plants.

74. HARTER, L. L., AND OTHERS. 635.656-2.3/4
Pea diseases and their control.
Fmrs.' Bull. U.S. Dep. Agric., 1735, 1934, pp. 24.

Brief and simple descriptions are given of the symptoms of the chief pea diseases and suggestions are made for prevention and control. *Aschochyta* blight is seed borne. Only clean seed must be used. All refuse after harvesting should be burnt and peas should be rotated with other crops. The same applies to bacterial blight, *Bacterium Pisi* Sack. The *Fusarium* wilt organisms live almost indefinitely in the soil and the only control lies in the use of resistant varieties. Root rots are caused by a number of different organisms, losses can be reduced by proper draining, cultivating and crop rotation. Root knot is caused by an eelworm in the sandy soils of California. Certain cowpeas, grasses and cereals are resistant and should be used in the rotation. Powdery mildew can be controlled by sulphur dusting. *Septoria* blight, anthracnose and downy mildew are of only slight importance.

75. PETHYBRIDGE, G. H. 635.656-2.8
Marsh spot in pea seeds.
J. Minist. Agric. London, 1934, 41 : 833-49, bibl. 12.

The author discusses previous work on the subject in this country and in Holland. He describes with clear illustrations the symptoms of the disease in pea embryos and seedlings and shows how the search in England for a possible pathogen has been negative and has strongly indicated that the lesions are not due to any parasitic micro-organism. The malady is characterized by the death of larger or smaller portions of the cotyledon tissues and sometimes of the plumule of the embryo pea. Germination of affected seed is hardly affected, but the seedlings are generally defective and are thus handicapped at the outset. It is thought that Marsh Spot is not a seed-transmitted defect but apparently occurs afresh as the physiological result of unfavourable soil conditions. What these conditions are exactly remains to be discovered, though excess moisture may be one. [Furneaux and Glassock are studying the problem at Wye and have a paper in preparation.—ED.]

FLOWER GROWING.*

76. WEINARD, F. F., AND DECKER, S. W. 635.936.69 + 635.937.34
Experiments in the use of old soil in growing carnations and roses.
Bull. Ill. agric. Exp. Sta., 400, 1934, pp. 24, bibl. 5.

Carnations. Observations were made for some 14 years on the comparative results of changing the soil for glasshouse carnations and merely amending the old soil by the addition of manure,

* See also 67.

lime or steaming. On the average carnations produced about 11 per cent fewer flowers on old than on new soil. There was no progressive decrease in yields, nor any important differences in stem lengths or diameters of flowers. There are indications that liming increased yield. Steaming the soil was very effective in increasing numbers and improving quality of flowers and crops cut from steamed old soils were as good or better than those from new soils. Neither liming nor steaming had any marked effect on the number of plants lost which was only very slightly greater on old than on new soils. Split flowers which were unaffected by liming or steaming were slightly fewer on the old soils. Where old soil can be treated with steam, it can be kept in a highly productive state indefinitely. *Roses*. Tests were carried on for 3 years. Although young rose plants planted in old soil yielded materially fewer flowers than those planted in new soil, transplanting 2- or 3-year-old roses did not result in increased flower yields probably owing to the check thereby incurred.

77. PETHYBRIDGE, G. H. 635.939.516-2.452

Snapdragon (*Antirrhinum*) rust.

J. Minist. Agric. London, 1934, 41 : 336-40.

Antirrhinum rust (*Puccinia Antirrhini*) was first recorded in England in 1933 though it is almost certainly not the first year of its occurrence. Its attacks are often devastating. All attempts to transmit the rust through *antirrhinum* seed have been unsuccessful. Two kinds of spore pustules are produced, the earlier one, brown and powdery, contains large quantities of summer spores or uredospores which disperse and are responsible for the rapid spread of the disease throughout the summer. They retain their vitality for about six weeks. The rust overwinters by means of teleutospores contained in nearly black spore pustules. These germinate the following spring, not very readily, but the basidiospores thus produced cannot be made to infect the *antirrhinum*, hence another kind of host is probably needed before the rust can complete its life cycle. The alternative host is unknown and may not be present in England so that the only chance of the rust overwintering successfully is by means of summer spores on plants under glass or in the open in mild districts. This has been shown to occur in U.S.A. Thus the total destruction of all *antirrhinums* before winter each year should be a useful means of control. Dusting with finely divided sulphur under glass with a day temperature of 70° F. and a night one of 50° F. has been found effective. This treatment might prove effective in the field in a hot summer.

78. WALLACE, J. C., AND HORTON, D. E. 635.944

Some factors in commercial bulb production.

Sci. Hort., 1935, 3 : 167-73.

and,

GIBSON, G. W.

635.944-1.8

Some observations on the manuring of bulbs.

Ibidem, 1935, 3 : 174-83, bibl. 19.

The first authors deal in a general but practical way with the following problems :—climate and soil, grading, planting and cultivation, bulb storage. Gibson deals with manuring in its widest sense, i.e. the handling of the soil as well as the addition to it of manure. He deals separately with hyacinths, tulips and narcissi and with the different treatments necessary according to whether the aim of the grower is flower or bulb production. Results to date in this country are suggestive rather than conclusive and further work is necessary.

79. BLAAUW, A. H. 635.937.9-1.544

De grenzen der bloeibaarheid bij bol-irissen I. (The limits of flower-forming capacity in bulbous irises.) [Dutch-French summary.]

Meded. Lab. PlPhysiol. Wageningen, 41 : 1934, pp. 11.

Bulbs of the Dutch iris *Imperator* of 8 cm. circumference when lifted will flower the following year and bulbs of less than 4 cm. will not flower, irrespective of the temperature they have

experienced the previous summer. But bulbs of 5-6 cm. are on the borderline and the flowering or not of these is decided by the temperature during August to October, though the actual flowers are not differentiated until February-March. During these 3 summer months up to 3 leaves are laid down in the bulb, the optimum temperature for leaf formation being 11-13° C. while a temperature of 23° C. will only produce a single leaf, but a very high percentage of the bulbs will flower. The internal changes which take place in a borderline bulb, (a) when it is not going to flower and (b) when it is going to flower, are described.

80. LUYTEN, I., AND BLAAUW, A. H. 635.937.9-1.544
De snelle bloei van *Iris tingitana*. (**Forcing *I. tingitana*.**) [Dutch-English
summary.]

Meded. Lab. PlPhysiol. Wageningen, 40 : 1934, pp. 7, bibl. 6.

Iris tingitana bulbs were lifted on July 31st and kept at a temperature of 28° C. until August 24th, when they were planted in boxes in sand, one group being placed in a temperature of 9° C. and the other at 5° C. Unlike the tulip and hyacinth in which the flower or flower cluster is brought to a certain point of development within the bulb before it is removed to a lower temperature, or the narcissus in which the flower is completely formed at the time of lifting, no flower had formed within the bulb of the iris at the time of planting and transference to the cool houses. The bulbs were kept at 9° C. and 5° C. respectively until they had obtained a length of 3 cm. when both sets were placed in 13° C. until 6 cm. in length and then in 17° C. until they flowered. Those whose treatment began at 9° C. flowered in the shortest period, 121 days, while those of comparable size started at 5° C. took 180 days, the small difference of 4° resulting in a difference of 59 days. These results can be considered as forming a basis for early forcing of *I. tingitana*.

81. TAVERNETTI, J. R., AND EMSWELLER, S. L. 635.944 : 631.588.1 : 631.544
Forcing gladiolus outdoors by heating the soil with electricity.
Bull. Calif. agric. Exp. Sta., 584, 1934, pp. 14.

The authors had equal success in their heating experiment in the open field, in closed frames and in open frames. The heating cable used consisted of a resistance wire insulated with felted asbestos and enclosed in a lead sheath about $\frac{1}{4}$ in. in diameter. It had a resistance of $\frac{1}{2}$ ohm. per foot and was connected to a 110 volt circuit. The cable was buried 5 to 6 in. deep in trenches and ran in loops about 12 inches apart. The heating was started at different dates in January in all three cases and was continued for 100 days. The time required to induce gladioli to bloom was shortened from 2 to 6 weeks by heating the soil to a temperature of 60° to 70° F. Heating for 60 days was more efficient than heating for 35 days and equally efficient (sometimes more so) as heating for 100 days. The quality and number of spikes were not affected by the treatment. Notes of costs are given.

82. BEAUMONT, A. 635.944-2.3/4
Diseases of narcissi and tulips.
Sci. Hort., 1935, 3 : 184-91.
and,
HODSON, W. E. H. 635.944-2.6/7
Control of insect pests of bulbs : a survey of recent work.
Ibidem, 1935, 3 : 192-6.

The first author deals somewhat lightly with the phenomena responsible for the many variously named diseased conditions in narcissi and tulips and then gives suggestions for control. As yet these are largely sanitary measures. Hodson describes the eelworm pest, for which there is no proved remedy; narcissus fly damage, remedies being hot water treatment, capture of adult fly etc.; the bulb scale mite, the remedy being biennial hot water treatment; stripe probably a virus; lily thrips.

The following also are noted :—

KATTERMANN, G. Cytologische Feststellungen bei *Primula malacoides*. I. Mitteilung. Die diploiden Rassen. (Cytological determinations in *P. malacoides*. 1st Report. The diploid races.)

Gartenbauwiss., 1934, 9 : 120-34, bibl. 3.

IMAI, Y. Ursprung u. Entwicklung, Vererbung u. Züchtung der japanischen Trichterwinde. (Origin, development, inheritance and breeding in *Pharbitis Nil Choisi*.) *Gartenbauwiss.*, 1934, 9 : 135-41, bibl. 10.

CITRUS AND SUB-TROPICALS.*

83. BODENHEIMER, F. S. 634.3
A visit to the citrus district of southern Turkey, April, 1934.
Hadar, 1935, 8 : 10-4.

The orange plantations of southern Turkey mainly consist in the older orchards of the thin-skinned Algerian orange, raised entirely from seed. The yield of oranges per tree is very high, being from 2,000-6,000 fruits per tree for middle sized trees and from 10,000-15,000 fruits for a large tree. The price obtained for the local variety is as low as £T3 per 1,000 while fruits of the Jaffa orange, which is gradually coming into cultivation, fetched £T50 per 1,000 in 1933. In the newest plantations of the more enlightened growers budding is now practised, the rootstock being the bigarade variety of the sour orange. The author considers that owing to climatic conditions a citrus mono-culture such as exists in Palestine can never develop. Precautions against pests and diseases are practically nil, and as grading is unknown on the Turkish market, which absorbs most of the fruit, there is no inducement for the grower to market clean fruit with a view to improved prices.

84. GRIPPO, N. 634.334 : 575.252
Evoluzione della coltura agrumaria nella costiera Amalfitana. (Citrus growing on the Amalfi coast.)
Reprinted from *Picentino*, 1933, Vol. 89, Nos. 4, 5, 6, 10, 11, 12 and 1934, Vol. 90, Nos. 3, 4, 8, 9.

This is chiefly interesting for the account given of a seedless bud sport of the Ovale variety of lemon which has now been propagated extensively both at Cetara and in other districts under different conditions without showing any loss of its particular valuable characters. It has not only seedless fruits but also spineless branches, its fruits well and has a higher citric acid content than the normal Ovale type.

85. READ, F. M., AND PROVAN, J. L. 634.31
Citrus industry in Victoria. Factors affecting present economic position.
J. Dep. Agric. Vict., 1934, 32 : 523-30.

A recent Departmental census reveals a marked decline in citrus acreage in Victoria, a total decrease for the State since 1926 of 60,000 Washington Navels and 13,000 Valencia Lates. The number of grape fruit has doubled and there are now 14,000 trees. A standard of quality for each variety based on the percentage of rind, juice, rag, acidity and Brix², has been set up and has given consistent results for two years. Particular care is needed that only true strains are propagated, particularly of Washington Navel, a variety very liable to bud mutation. Off-type and mixed strains are common and a committee to consider the nomenclature of citrus trees is needed. A comparison made for quality of fruit between 24-year-old trees of Valencia Late on sour orange rootstock and 9-year-old trees on rough lemon, the stock on which 90% of the trees in the State are grown, showed that the fruit on the older trees on sour orange had thinner rind, less rag and more juice than the trees on rough lemon. Rough lemon as a rootstock is criticized on the grounds that it is short lived under irrigation conditions and that the abnormal vigour of the orange tree worked on it is responsible for a large proportion of the low quality fruit

* See also 33.

produced during recent years. Soil and climatic changes appear to be closely connected with the quality of the fruit. Investigations are in progress to correlate such variations in quality with environmental conditions. Other factors which have a direct bearing on fruit quality are seasonal influence and exposure to wind. Seasonal influence also affects quality indirectly through yield, since the quality of fruit on heavily bearing trees is always superior to that of trees bearing a light crop. Critical results from manurial trials under local conditions are not available, but the application of 5 cwt. per acre of sulphate of ammonia, applied so as to secure its availability at the time of the "drop" is advised. In regard to irrigation improvement in the health of the trees has resulted from the introduction of shorter irrigation runs of 3-4 chains, ensuring a more uniform distribution of soil moisture, and in saline soil alkalinity has been markedly reduced by the liberal application of gypsum combined with flood irrigation. In the past four years 3,000 trees of unprofitable varieties have been reworked and many are now bearing good quality fruit. A table is given showing the causes of decline of 140,579 citrus trees. Neglect is responsible for 37,655, over irrigation and seepage for 31,269, unsuitable soil 25,577, insect pests 10,225, fungus diseases 15,830, salt 8,842, frost 8,786. The research programme of the State covers soil irrigation, manuring, rootstocks.

86. BARNES, A. C. 634.3
Cultivation of citrus in Jamaica.
J. Jamaica agric. Soc., 1934, **38**: 776-81, being *Bull. Dep. Sci. Agric. Jamaica*,
3 (New Series).

The extension of citrus culture in Jamaica forms one of the major activities of the Department of Agriculture and Science. Considerable differences of opinion exist among planters and others as to the methods to be employed during the various stages of propagation and subsequent cultivation. It was thought advisable to encourage the use of uniform methods throughout the island. A Conference of the Department officers and others concerned with the Government Citrus Extension Programme was called, and resulting from its deliberations a memorandum was issued setting out the main points which should be carefully followed by those engaged in the cultivation of citrus in Jamaica. Essentials which are common practice in all countries are not described. The memorandum contains much practical information provided by experienced men and is valuable because it gives an authoritative ruling on a number of debatable points and deals with the smaller details of technique which though important are often hurried over or disregarded by compilers of text books.

87. ARNDT, F. R. 634.31:575.252
Report of an investigation into the nature and condition of Washington Navel orange trees growing in various orange groves of the Berri irrigation area.
Bull. Dep. Agric. S. Aust., **294**, 1934, pp. 131-7.

The trees surveyed in 7 typical orange groves in 1927 to 1932 were rather over 5,000. The actual crops were based on estimates, the comparative accuracy of which was, however, established by occasional checks with growers' figures at harvest. Points noted included:—habit of tree, condition of growth, cause of condition of growth, quality of fruit, size of fruit, approximate crop in bushel cases. About 14% of the trees were found to be "off type", being more upright in growth, sparser in foliage and having fruit with a rougher and thicker skin and more acid flavour. On one plantation most of the "off type" trees were found in a section by themselves. Here the good and bad trees had apparently been budded in quantity from parent trees of two distinct types, probably by different nurserymen and had been but little mixed when planted out in the orchard. In another case the presence of a few "off type" trees among the normal type may perhaps be explained by the accidental budding of such types by the nurserymen supplying all the trees in that area. In some cases single limbs were found to be "off type". Had budwood from such trees been used during the spring or early summer months, it is seen how the "off type" strain could have been propagated. Apart from such phenomena due to the make up of the plant the effect of environment was very great. As regards soil trees generally grew well when the land was fairly loose and there was a depth of 2 to 3 ft.

above a subsoil of loose calcareous marl. Stunting was noticeable where a considerable part of the soil surface was washed away by steep irrigation runs. Salt or seepage troubles also accounted for a certain amount of poor growth. Drains put down before the trouble had arisen appeared to prevent it, but drainage after the trees had become affected was of no use. Only few trees were found to rise appreciably about the normal in cropping, averaging 8 cases per tree per year. Though part of their productiveness was undoubtedly due to environment, such trees would of course make good parent trees for propagating purposes if only for the quality of their fruit. It is pointed out that such a survey shows up the inferior trees which might well be worked over to trees of better type, and so become more profitable.

88. PROVAN, J. L. 634.31

The Valencia Late orange in Victoria.

J. Dep. Agric. Vict., 1934, 32 : 581-4.

In Victoria the late maturity of this orange extends the orange season through the summer months. It is now practically the only seed orange recognized as a commercial possibility. The growth is large, upright and vigorous, easily distinguishable from the flat pendulous habit of the Washington Navel, the other principal orange grown. The Valencia is classed as a seed orange, but often it contains 2 or 3 seeds only or it may be quite seedless. Being parthenocarpic pollination is not necessary for the production of fruit and in fact only results in the formation of seeds. Extra seediness in Valencias is often experienced by the owners of mixed groves on account of the natural cross-pollination which takes place. The degree of seediness in the tree is also influenced by soil and climate, certain conditions favouring the development of viable pollen. The history of the orange is given in some detail. In California trees 54 years old are still in full productivity while in Mildura, Victoria, trees nearly 40 years old give good crops of fine quality. The habit of the Valencia Late when fully mature of reverting from an orange to a green colour although perfectly ripe is under investigation and experiments are in progress to discover whether this is a characteristic of one strain or due to rootstock and environmental influences. Biennial bearing, a characteristic of this orange, might be perhaps minimized by judicious thinning of newly set fruit in the heavy crop season as is done with mandarins and some stone fruit, or heavier fertilizer applications might be given during the heavy crop year. The trees would benefit if pruning were more frequently undertaken. All limbs within 1 ft. or 18 in. of the ground should be cut out, and unwanted water shoots, crossing limbs, diseased and dead wood and too dense foliage should be removed. The Valencia seldom bears fruit in the centre of the tree so that thinning on similar lines to Navel orange tree pruning is not necessary. Oranges, lemons and mandarins have been successfully rebudded with Valencias. Budded on rough lemon stock the Valencia is harder than the Washington Navel. The use of a disc cultivator (illustrated) having one set of discs extended laterally and protected by a metal cover so that it can pass under the fringe of foliage without damaging fruit or branches, has been found beneficial. An attachment for forming an irrigation furrow can be fitted to this machine.

89. BHAT, S. S. 634.31 : 581.45/46

The leaf, flower and fruit characters of the Santra orange.

Poona agric. Coll. Mag., 1934, 26 : 116-26.

The Santra orange is a variety of *Citrus nobilis* called var. *deliciosa* by Swingle. It is one of the principal oranges grown in India, nevertheless detailed studies of the variety such as is presented here are rare. Those interested should note the reference.

90. BHAT, S. S. 634.31-1.541.11

The development of Santra bud on Jamburi stock.

Agric. Live-Stk. India, 1934, 4 : 624-32, bibl. 2.

The Santra orange of India is *Citrus nobilis* Lour var. *deliciosa* Swingle. Jamburi is a variety of the rough lemon, *Citrus Limonia* Osbeck var. *Jamburi* Hort. Santra buds are usually multiple but in a growing tree give rise as a rule to only one or occasionally two buds. When, however, the bud is placed on a vigorous stock it sends forth, if not immediately at any rate after it has

been headed off, numerous shoots which give the plant a crowded and bushy appearance. Only one or two of these have any vigour, but Indian nurserymen are prone to encourage the idea that the large number of sprouts indicate a superiority in the budded plant. The author gives a very detailed and careful account of the development of the plants from bud to maturity.

91. NICHOLS, A. F. 634.3-1.541.11

Production of budded citrus plants in St. Lucia.

Trop. Agriculture, 1935, 12 : 23-4.

The routine methods followed do not differ from those generally used in citrus propagation, but the rigid methods of selection used in the production of rootstocks should be noted. The seeds are selected for size and shape from healthy fruits of high yielding, sour orange trees. From 40-60 per cent of the seeds are discarded as being too small or thin. The result is an improved germination and a uniform stand of vigorous seedlings. When the seedlings are transplanted, which occurs when they are 5-7 months old and 10 inches high, a further 20 per cent are discarded on account of weakness, slowness of growth or "bench roots". When lifted the tap root is trimmed with a sharp knife to a length of eight inches. When budding it has been found that slightly angular bud wood gives the best results.

92. HOLLAND, F. L. 634.3-1.8

Citrus fertilizers and lime.

Citrus Ind., 1934, 15 : 10 : 6-7.

Changes in manurial practice in Florida have reduced the application of balanced fertilizers to citrus groves to 2 a year. The make up of these fertilizers is discussed and it is shown that the amount of calcium thus supplied to the orange groves has been on account of this change reduced by 50-75%. As a result some groves are showing the effects of calcium deficiency.

93. BENTON, R. J., AND BRYDEN, J. D. 634.3-1.874

A gypsum and green manuring trial with citrus.

Agric. Gaz. N.S.W., 1935, 46 : 7.

As a result of experiments begun in 1928 and continued to the present date to discover the effect of gypsum and green cover crops on Washington Navel trees the following conclusions were reached. Gypsum, 2 tons per acre applied in 1928, failed to increase yield while the mechanical effect disappeared in about 3 years ; during this period, however, cultural and irrigation practices were more easily carried out. Tick beans as a green manure are useful in increasing productivity, weeds are beneficial to a lesser extent, while barley definitely depreciates the yield. Under the conditions of the experiment an additional fertilizer of high nitrogen content was necessary to supplement the plant food available in the soil.

94. SHAMEL, A. D., AND POMEROY, C. S. 634.31-1.542.24

Progress report on girdling Washington Navel orange trees.

Calif. Citrogr., 1935, 20 : 94, 101.

This study has been carried on without interruption since 1928.* The method of girdling has been to make a single cut each year entirely round the tree trunk with a grape knife. The loss of sap has been very small and the trees have healed within a few weeks. Another method now being used commercially in California is to be included in future studies. With this system a shallow groove is made with a special tool round the trunk, cutting only partly through the cambium. [This tool is described and illustrated. *Calif. Citrogr.*, 1934, 19 : 177 (*H.A.*, 1934, 4 : 2 : 258).—ED.] Results to date show that the tendency of girdling in this experiment is to raise yields for the first two or three years but to reduce yields somewhat subsequently. Omission of girdling after one or more treatments consistently results in a sharp drop in yield. The practice of girdling citrus trees in California by the method described is being largely discontinued probably as a result of these and other experiments.

* Earlier accounts of this experiment appear in *Calif. Citrogr.*, 1931, 16 : 263 ; *ibid.*, 1932, 18 : 38 (*H.A.*, 1933, 3 : 1 : 87) ; *ibid.*, 1934, 18 : 328 (*H.A.*, 1934, 4 : 1 : 105).

95. CAMP, A. F. 634.3-2.19
The use of zinc sulphate on citrus.
Citrus Ind., 1934, 15 : 10 : 16.
 and,
 PARKER, E. R. 634.3-2.19
Experiments on mottle leaf by spraying with zinc compounds.
Calif. Citogr., 1935, 20 : 90, 106-7.

Frencing (mottle leaf or chlorosis) of citrus is distinguished by a yellowing between the veins of the leaves with the areas along the veins and the edge of the leaf remaining green. In severe cases the leaves become small, large twigs and even limbs die back, the yield of fruit becomes insignificant and the fruits produced are small and hard. The condition is usually most severe on sandy soil. This condition, however, it has now been found, yields completely, and in a few weeks, to a treatment of zinc sulphate applied as a spray. The most reliable formula is 5 lb. of 89% zinc sulphate, 2½ lb. finely ground hydrated lime, 50 galls. water, calcium caseinate or blood spreader. The zinc sulphate should be dissolved separately in a small amount of water to which it should be added slowly with vigorous stirring, otherwise it will lump. The hydrated lime is added slowly to the spray tank with the agitator working, and when a good suspension has been obtained the zinc sulphate solution is added, again slowly. The spreader is used according to instructions on the packet. The agitator should not stop working till the tank is empty. Zinc sulphate applied without lime burns the foliage. It may be applied with good success mixed with lime sulphur, 5 galls. 89% zinc sulphate to 100 galls. 1 : 50 lime sulphur. There is, however, with this mixture the risk that the amount of free sulphur thrown down by the zinc sulphate may reduce the killing power of the spray for rust mite and scale. Zinc sulphate can be used with bordeaux as follows :—5 lb. zinc sulphate and 2½ lb. lime to ordinary bordeaux mixture. If the bordeaux is as strong as 4-4-50, increase the lime by a further 1 lb. The zinc sulphate treatment is of quite recent origin and the duration of its effects is not known. In the case of tung oil trees, where it is used as a cure for bronzing of the leaves, an annual application is definitely necessary. The treatment is also remedial for rosette of pecan and white bud of corn. Soil applications of zinc sulphate have been less successful in the case of citrus than with other crops. The above notes are on Camp's article. The information given by Parker is substantially the same.

96. PARBERY, N. H. 634.31-2.191-1.811.6
Mineral constituents in relation to ehlorosis of orange leaves.
Soil Sci., 1935, 39 : 35-45, bibl. 17.

Chlorosis or yellowing of orange leaves has become more pronounced of recent years in the Gosford district of N.S. Wales. The affected leaves first show diffused yellow, interveinal areas rather towards the end of the leaf. Gradually the whole leaf becomes yellow with, initially only, a greenish tinge along the main veins and midrib. Chlorotic leaves tend to occur on the side of the tree which receives the greatest intensity of light. They are narrower than normal leaves and in bad cases are not confined to individual limbs but are distributed over the whole surface. They are subject to marked abscission in winter. The author discusses the results of other investigators working on chlorotic conditions in citrus and in deciduous fruit trees, describes his own work at Gosford, and gives analyses of normal and of affected leaves. The following points are taken from his summary. The salient feature in comparing the mineral composition of healthy and diseased leaves is the deficiency of magnesium in the latter. Normal leaves have a significantly greater content of Mg and N. The content of K, Na, Si, Cl, is higher in the chlorotic leaves, while there is no significant difference in the ash, Ca, Mn, Fe, SO₄ and P₂O₅ content. The composition of normal leaves grown under very different soil and climatic conditions elsewhere differs little from that of normal leaves at Gosford. The major replaceable base constituents of a number of soils at Gosford are given. There is no significant degree of correlation between replaceable bases in these soils and the uptake of the corresponding bases.

97. KLOTZ, L. J., AND FAWCETT, H. S. 634.31-2.19
Rind breakdown of Navel orange.
Calif. Citrogr., 1935, 20 : 124, bibl. 3.

A destructive breakdown, probably caused by the internal and external liberation of rind oil, which browns the tissues, has occurred in the current harvest of Washington Navel oranges. Orchards where temperature changes have been greatest suffered the most from the breakdown. Sudden lowering of temperature caused the liberation of rind oil on water-filled fruit. Oil injury can be caused by picking and handling fruit too soon after rain or before the dew has dried off the surface of the fruit. In the packing houses ethylene appears to accentuate the breakdown. Control measures are limited to very careful handling and delay in picking until there is a total absence of water on the surface of the fruit. The period of immersion into wash water and soaking tank should not exceed six minutes. The minimum of ethylene should be used when artificial colouring is necessary.

98. BAKER, R. E. D. 634.3-2.411
Gummosis of citrus in Trinidad. I. Marsh grapefruit on sour orange stock.
II. The causal organisms.
Trop. Agriculture, 1934, 11 : 236-9, bibl. 2, and 1935, 12 : 36-42, bibl. 9.

I. A preliminary survey of the Marsh grapefruit estates in Trinidad showed that gummosis was widespread and serious. Predisposing factors are low forking of the tree, low branches touching the ground, low planting, lack of drainage and cultivation. Trees budded high on sour orange stock are less liable to attack than trees budded low on the same stock, which itself is highly resistant to gummosis. II. A brief account of the taxonomy of 3 species of *Phytophthora* concerned in gummosis diseases of citrus is given. The two species associated with the disease in Trinidad are *P. parasitica* Dastur and *P. palmivora* Butler. The former is mainly responsible for gummosis, while both cause brown rot of fruit.

99. WAGER, V. A. 634.3-2.48
Bleaching citrus fruits for removal of sooty blotch blemish.
Fmg. S. Afr., 1935, 10 : 81-2, bibl. 1.

A bleaching mixture known as eusol, prepared by mixing 1 oz. each of chloride of lime and boracic acid in $\frac{1}{2}$ gallon of water, was found to cleanse citrus fruits of sooty mould (*Gloeodes pomigena* Colby) almost instantaneously, whereas with the ordinary solution consisting only of 5 per cent chloride of lime, or $\frac{1}{2}$ lb. to 1 gallon, the treated fruit has to be exposed to the air for from ten to sixty minutes. The treated fruits were rendered perfectly clean and uniform in colour.

100. QUAYLE, H. J., AND ROHRBAUGH, P. W. 634.33-2.944-2.752
Temperature and humidity in relation to HCN fumigation for the red scale.
(*Aonidiella Aurantii* Mask.)
J. econ. Ent., 1934, 27 : 1083-95.

Experiments were made on infested rooted lemon cuttings. They and the scales on them were exposed to different temperatures both before and during fumigation and to different humidities during fumigation. In the first series of experiments no significant difference in mortality occurred in scales fumigated at 50° F. and at 90° F. or at intermediate temperatures. In a second series preconditioning scales prior to fumigation had a very striking effect, scales preconditioned for any period from 4 to 48 hours at 50° F. showing a higher mortality in all cases than those preconditioned at 90° F. irrespective of the actual fumigation temperature. Humidity within a range of 50 to 80% during fumigation did not significantly affect mortality. Fumigation humidities of 85 to 100% resulted in a lower scale mortality than humidities of 27 to 40%. The effects of the different humidities on damage to the lemon cuttings are discussed.

101. QUAYLE, H. J., AND EBELING, W. 634.3-2.752-2.944
Spray-fumigation treatment for resistant red scale on lemons.
Bull. Calif. agric. Exp. Sta., 583, 1934, pp. 22, bibl. 9.

For some years now it has been apparent that the various citrus scales are, at least in certain localities, showing a greater tolerance of HCN fumigation. As a result not entirely successful attempts have been made to control scale by oil sprays alone. In experiments described here in 13 lemon groves a comparative account is given of the success achieved by oil spraying alone, by oil spraying followed by HCN fumigation, of fumigation alone and of two fumigations. The result of spraying followed by fumigation was definitely the best, scale mortality being 99.63 to 100% on the branches and 98.86 to 100% on the fruit. Two fumigations resulted in 99.42 to 100% and 97.35 to 100% on branches and fruit respectively. A single fumigation was definitely inferior especially as regards branch scales, while spraying alone was inferior both as regards branch and fruit scales. The specifications of the spray used are given by Smith in *Bull. Calif. agric. Exp. Sta.*, 527, 1932, to which the reader is referred.

102. PROVAN, J. L. 634.3-2.944
Fumigation of citrus trees.
J. Dep. Agric. Vict., 1934, 32: 613-9, 633 and 1935, 33: 5-16, bibl. 7.

The factors influencing the success of the operation of fumigation of citrus trees in Victoria for the control of red scale are discussed. The fumigant is calcium cyanide which is best obtained in the forms known commercially as Calcid Briquettes and Cyanogas. The latter is sold in two forms, "A", a fine ash-like powder, and "G", a more granular product. "A" is used when humidities are below 45 per cent and "G" when they are higher. Fumigation is performed at night because the tree is then less susceptible to hydrocyanic acid gas. The tree is completely enclosed in a gas tight covering of closely woven calico or duck and the correct dose of calcium cyanide (ascertained by reference to the manufacturer's chart) is then blown in by means of a rotary fan blower. The tree remains covered for 45 minutes and the sheet is then floated by means of poles and ropes to the next tree. The sheets are 36 ft., 45 ft. and 56 ft. across and a heavy material is better in several ways, of which durability is the most important, than a light one. Measuring tapes are now in use which automatically show the dosage required; this is based on the volume of the tree. Accurate wet and dry bulb thermometers are required; otherwise the humidity may rise unnoticed above danger level and the tree be damaged. Projecting pieces of dead wood should be removed from the tree so that the tents may not be pierced. Irrigation should be completed 3 weeks before fumigation and the surface soil should be dry. It should be cultivated to a fine tilth which will ensure that the edges of the sheet rest closely on the ground. Weeds affect fumigation unfavourably by absorbing excessive amounts of gas if under the tent, and if outside by providing a source of reinfestation. The dosage required is ascertained from a chart and varies according to humidity, low humidities requiring a higher dosage. In applying the cyanide dust the aim should be to form near the soil surface a good cloud which will gradually rise and filter through the foliage. The presence of a wind in excess of 5 miles an hour is thought to reduce the concentration of gas through leakage caused by the movement of the tent. Water either as dew or rain reduces the concentration because this gas has a marked affinity for free water. Tolerance of the gas by the tree varies with the physiological condition of the tree. Fumigation is less dangerous at night when assimilation is at its lowest. Varietal tolerance is also marked. It has been shown by American workers using HCN that varietal tolerance in descending order is as follows:—lemon, grapefruit, seedling orange, mandarin, Valencia Late, Navels, Homosassa, St. Michael and Mediterranean Sweet. With Cyanogas dust, however, the lemon is more susceptible owing to the residue of dust remaining on fruit and leaves. Healthy trees grown under hard conditions and trees on heavier soils are more tolerant than trees growing in favoured situations or on light soil. Most of the fumigation damage could be avoided, if the work were not carried out when conditions were unfavourable such as when high temperatures and high humidities occur simultaneously especially in combination with sunlight. With a low temperature and high humidity or *vice versa* fumigation will generally be safe at night. Some of the many forms that fumigation injury may take

are described. Disastrous results have followed the fumigation of trees too soon after the application of a bordeaux spray, the formation of the harmful material, cupric cyanide, being determined by the ratio of copper sulphate to quick lime used in making the mixture. A combined treatment of white oil emulsion spray followed in a week or two by fumigation is a very effective first measure for trees heavily infested with red scale, and thereafter less drastic measures would be effective.

103. PETERS, G. 634.3-2.944

The HCN aspirimeter.

Calif. Citrogr., 1934, 20: 62, 79.

A description of an instrument by means of which a clear picture can be obtained during tree fumigation of the gas concentration and distribution at 10 different points under the tent practically simultaneously. The instrument consists of a series of pumps constructed to suck up equal quantities of air or a mixture of air and gas respectively per unit of time. The apparatus is described fairly fully in a general way and is illustrated by a photograph and drawing. Four diagrams are given showing how the readings are plotted and interpreted. These particular diagrams illustrate the possibilities of the apparatus in such cases as (1) ascertaining the gas distribution obtained with the pot method, sodium cyanide + sulphuric acid; (2) the difference in gas leakage between new heavy 8 oz. duck tents and already used 6 oz. duck tents; (3) comparison of differences of distribution resulting from the fumigation with a high grade calcium cyanide but inefficient dusting apparatus; and (4) with the use of an improved apparatus.

104. COSTANTINO, G. 634.3-2.944-2.752

Norme e dati economici per la confezione di tende da fumigazione. (Directions and economic data on the preparation of fumigation tents.)

Boll. Staz. sper. Agrum. Frutt., Acireale, 3, 1935, pp. 19.

The author utters a strong plea that more private citrus growers or associations of growers should possess their own set of fumigation tents. He gives detailed instructions on the choosing of a suitable cotton cloth which must fulfil certain strength and density requirements. He next discusses the sizes necessary for different varieties of tree in different stages of development, showing the waste inevitable as the result of using excessively large tents. Finally he deals with the exact measurements and the actual process of making the tents, noting the amount of labour necessary for cutting out, marking and sewing up the material according to the size of the tent. The shape preferred by him is octagonal, octagonal tents requiring less material and hence being lighter and more easy to manœuvre.

105. ROHRBAUGH, P. W. 634.3-2.752-2.951.8

Penetration and accumulation of petroleum spray oils in the leaves, twigs and fruit of citrus trees.

Plant Physiol., 1934, 9: 699-730, bibl. 17.

The author describes in detail a method of staining sections of leaves, stems and fruit whereby the natural plant oils may be distinguished from the petroleum spray oils used for the control of scale and red spider. Further a method is described for measuring the petroleum oil extracted from citrus tissue. The oils appear to enter plant tissues by capillarity. No evidence is found of any translocation or other movement of oils from leaves into twigs and further except over very short distances by capillarity between the cells. Tests indicate that about $\frac{1}{3}$ of the heavier oils disappear during the first 3 weeks after application, while $\frac{2}{3}$ to $\frac{3}{4}$ of the lighter oils may disappear during this time. After 6 months very little of a lighter oil remains while about $\frac{1}{3}$ of a heavier oil may still be present.

106. CASELLA, D. 634.343

La Casimiroa edulis, La Llave and Lex. (Sapote, white sapote, Mexican apple.)

Ann. Staz. sper. Agrum. Frutt., Acireale, 1934, 1 (N.S.): 215-8.

The author describes observations made on the growth at Acireale of seedling varieties of this sub-tropical fruit tree. It belongs to the *Rutaceae*, is evergreen and produces a very sweet fruit

whose shape varies from an asymmetrical long form containing one seed to a symmetrical, spherical or oval form with 3 or 5 seeds. When ripe the delicate skin will not allow of transport, but the fruits can be moved and transported when fully grown but not ripe, in which case they will gradually acquire practically all the characteristics of a naturally ripened fruit. Flowering in Sicily takes place in March or April and is then normally followed by an intense defoliation, to be succeeded by formation of new buds and often a second flowering. Large numbers of fruitlets drop during the brief leafless period. Cold damp weather just before or during flowering results in poor pollination and a very small crop, the latter, such as it is, being parthenocarpic. The tree is very resistant to drought and to heat but very susceptible to even slight frost in its earlier years, the top part being liable to die as the result of only a degree or two of frost, in which case the roots may send out new shoots the following spring. It needs a dry or at least a well drained soil, demands little cultural care and is resistant to disease. Wounds heal very quickly. Reproduction has so far been by seed, the essential being to sow the seed as soon as possible, as it quickly loses its power of germination. Germination takes place 3 to 6 weeks after sowing, the plants grow quickly and start fruiting in the 7th or 8th year. A method of vegetative reproduction recommended is dormant budding in June with buds taken from shoots which have only just lignified. The author while personally not liking the fruit considers that the beauty of form both of trunk and foliage of these trees and their comparative hardiness makes them admirably suitable for use in city boulevards.

107. CABEZON, A. G. 633.652
 Cultivo del aguacate. (**Cultivation of the avocado.**)
Agricultura, Madrid, 1934, 6: 736-40.

The article describes the cultivation of the avocado in California in order to show that it could be grown on commercial lines equally well in southern Spain and Spanish Morocco where it would be within easy reach of the European markets.

108. WOLFE, H. S., AND OTHERS. 634.652
Avocado production in Florida.
Bull. Fla. agric. Exp. Sta., 272, 1934, pp. 96, bibl. 31.

The cultivation of the avocado in Florida is dealt with very fully. The question of pollination is complicated by the fact that the avocado flowers do not shed pollen at the time when the stigma is receptive and that all the flowers on all the trees of any given variety are in the same condition at the same time. However, the opening times differ with the variety and thus by the interplanting of reciprocal varieties, lists of which are given, cross-pollination may be effected. There is considerable scepticism among growers as to whether reciprocal pollination is necessary in view of the heavy crops which can apparently be obtained without it. From data produced here it is shown that, while maximum yields cannot be obtained from solid plantings, it is not necessary to have reciprocating varieties nearer than every three or four rows. Varieties differ in their ability to set crops from solid planting and the problem requires the keeping of accurate records over a number of years. Pollination of some sort has been proved necessary to fruit set and in the case of non-reciprocating plantings it is apparently achieved by an overlapping in the opening and closing of the flowers of the variety, a condition which is largely influenced by sudden changes of temperature. The avocado is propagated in Florida by shield budding or grafting on seedling stocks, budding being done when the stocks are 3-4 months old. Shield budding is difficult and often unsuccessful, so that it is being superseded by various forms of grafting (whip, cleft, and side). Grafted plants make fruiting trees in a shorter time, the grafts unite without difficulty and suitable scions are more easily obtained than suitable budwood. Rootstocks used are of the West Indian variety and are raised from seed obtained from Cuba. The Guatemalan variety as a stock is thought to give rather more cold resistance. Scions of West Indian varieties succeed on their own stocks and on the Guatemalan but not on the Mexican varieties. Guatemalan scions succeed on stocks of all three races. Mexican seedling stocks are

erratic, some being exceptionally vigorous, others the reverse. Trees of uncommercial varieties can be topworked by cleft grafting. The process, as modified to apply to the avocado, is described and illustrated. On sandy soils clean cultivation is given during the dry season followed by cover crops down the centres of the rows in the summer rainy season. On the lime rock soils cultivation is unwise. Weeds are allowed to grow and are cut down at intervals or, if a cover crop can be established, it is treated the same way. There is no systematic method of pruning beyond the removal of dead wood. Trees of fruiting age are manured in spring with a mixture containing 5% ammonia, 8% available phosphoric acid, 3% potash, in summer with 4-7-5 and in autumn with 4-8-10 mixtures. Trees bearing exceptionally heavy crops should receive one or two light applications of ammonia intermediate to the regular ones. Thinning is not practised, but, on the analogy of other fruits, is probably desirable. There is no standardized test of maturity. A reasonably accurate method is to pick a few fruits and keep them for a week. If they soften properly and have the normal flavour of the variety they are ripe. Unripe fruits become tough and rubbery and begin to shrivel. Pests and diseases and their control are discussed.

109. CALIFORNIA AVOCADO ASSOCIATION.

634.652-1.541.11

Rootstocks (for avocados).

Calif. Avocado Assoc. Yearbk. for 1934, p. 31.

Research on the subject of rootstocks for avocados has just been initiated by the Association. At the present time many avocados show marked uncongeniality between stock and scion, but beyond the general opinion that Mexican type stocks are the best there is no information. The investigation is to be conducted on the following lines, with the co-operation first of nurserymen and later of the planters of the trees. The stocks are to be raised from seed, each variety being from seed from 3 different sources. Blocks of these stocks are to be budded as far as possible with identical budwood. Experimenters will grow a block of carefully selected Guatemalan type rootstock and bud it with budwood identical to that used on Mexican type stocks. Sufficient seed is to be sown to allow of severe culling and seed must not be used from trees suffering from sun blotch or other serious disability. The great liability to variation through cross-pollination is a serious difficulty in selecting seedling rootstocks.

110. HODGSON, R. W.

634.652-1.55

How to overcome the alternate bearing of avocados.

Calif. Avocado Assoc. Yearbk. for 1934, pp. 92-8.

The author stresses the fact that experiments in connection with alternate bearing of avocado trees are scarcely a year old and that his statements are based on observations only. Alternate bearing in avocado appears to be inherent in the tree, but superimposed on that are the factors of weather conditions and the blooming and setting period. The exact correlations, however, are unknown. A point of interest is that avocado crops seem to be good when the walnut crop fails. The walnut fails through delayed spring development caused by too mild winters. Possibly the mildness of the winter is beneficial to the setting of avocados. In the on-crop year the fruit is certain to set well unless there is cold winter weather, but even this will not reduce the "on-crop" by more than 50%. In the "off-crop" year even the most favourable weather will not induce more than a very moderate set. In the experiments which are being initiated on- and off-crop trees will be paired and subjected to the same treatments. Some of the treatments are—increasing the nitrogen supply by 10 lb. per tree—reducing the nitrogen supply by the application of cellulose-cereal straw—removal of $\frac{1}{3}$ of the flowers at the beginning of bloom (the flowers are high in nitrogen content)—ringing certain branches by the removal of a strip of bark $\frac{1}{4}$ in. wide completely round the limb or in other cases spirally, so as to prevent complete separation—ringing and removing part of the crop. This last experiment has already given results. In the on-crop tree the girdled branch which had the fruit removed came into bloom this season three or four weeks earlier than the rest of the tree. Cross-pollination or insect activity appears definitely

to be immaterial to fruit setting in avocado. During the reading of this paper a grower mentioned an experience with two heavily bearing trees. The removal of a crop at maturity from one tree was followed by a fairly good crop next year whereas the tree on which the crop was allowed to hang for 3 or 4 months after maturity had no crop. Another grower stated that he always picked the crop immediately at maturity on account of thieves, yet still had alternate bearing.

111. SAN PEDRO, A. 634.652-1.534.4
Preliminary studies of the marcottage of the avocado.
Philipp. Agric., 1935, 23 : 681-7, bibl. 7.

The usual method of vegetatively propagating the avocado is by budding or grafting. These methods are beyond the powers of the Philippine peasant and therefore a quick and certain way of propagation by marcotting is sought. The avocado was found difficult to root by ordinary marcottage. It was noticed that the ring of bark which had been removed at the time of the operation completely callused over very rapidly but that the callus contained numerous protuberances in its upper region. It was suspected that these were rudimentary roots whose growth had been stopped by the healing over of the ring. By removing the lower portion of the callus so that the ring was reopened the initial roots in the upper portion grew strongly. So far it has not been ascertained whether a broader ring would induce rooting. The experiments are continuing.

The following also are noted :—

HAAS, A. R. C. **Relation between the chemical composition of citrus scale insects and their resistance to hydrocyanic acid fumigation.** *J. agric. Res.*, 1934, 49 : 477-92, bibl. 21.

ALGER, EULALIA, B. **Nutritive value of the avocado in the normal diet.** *Calif. Avocado Assoc. Yearbk. for 1934*, pp. 98-101.

DARBY, H. H., AND OTHER. **Studies on the Mexican fruit fly, *Anastrepha ludens* (Loew).** *Tech. Bull. U.S. Dep. Agric.*, 444, 1934, pp. 20, bibl. 20.

TROPICAL CROPS.

112. HARDY, F. 631.4
The chief soil types of Trinidad.
Proc. agric. Soc. Trin. Tob., 1934, 35 : 443-58.

The soils are described in detail and correlated with the requirements of the chief commercial crops of the islands.

113. WILBAUX, R. 632.951
Composition et propriétés toxiques des graines et des feuilles de *Tephrosia Vogelii* Hook f. (Composition and toxic properties of the seed and leaves of *T. Vogelii*.)
Rev. Bot. appl., 1934, 14 : 1019-27, bibl. 22.

The uses of *Tephrosia Vogelii* as a fodder, a fish poison, and an insecticide are discussed. As a dried fodder its composition resembles that of the vetch (*Vicia villosa* Roth) and contains 26.8% of albumen and 30.2% of raw cellulose. As a fish poison it is much used in Africa. The fish killed by it are not in any way rendered unfit for food. Subcutaneous injections of the juice are, however, poisonous to mammals and consequently it is occasionally used on arrow heads. As a contact insecticide it is fatal to aphids of various sorts but not to the larvae of *Diptera* or *Syrphides*. The toxic principle is deguelin $C_{23}H_{22}O_6$ which is an isomer of rotenone, and tephrosin $C_{23}H_{22}O_7$ which is hydroxy-deguelin and less active than the first.

114. WORSLEY, R. R. LE G. 632.951
The insecticidal properties of some East African plants, I.
Ann. appl. Biol., 1934, 21 : 649-69, bibl. 6.

Tephrosia Vogeli, a plant very widespread in East Africa, growing both on the plains at sea level and up to 5,000 and 6,000 ft., shows great promise. The toxicity of its extracts is found to be of the same order as nicotine in the form of sulphate and it is thought it will be able to replace nicotine in sprays against soft bodied insects such as aphids and thrips. Nearly all parts of the plant contain tephrosin, the seeds having the largest content, i.e. 0.35%. Methods for extraction are detailed. Solutions can be easily and cheaply prepared on the estate. Paraffin sprays of its extracts, although much less effective against *Antestia* and *Lygus*, were just as effective as pyrethrum against flies, mosquitoes, etc. Tests of two other plants, *Cassia didymobotrya* and *Barringtonia racemosa*, suggest that having about half the toxic properties possessed by nicotine sulphate these plants may nevertheless be a source of insecticides on estates where they grow wild, though they would not be worth cultivating.

115. OCHSE, J. J., AND TERRA, G. J. A. 63 : 613.2
 Het onderzoek naar den economischen en landbouwkundigen toestand en het voedselverbruik te Koetowinangoen. (**The agricultural and economic conditions of the natives and their food consumption in Koetowinangoen.**) [Dutch-English summary.]
Landbouw, 1934, 10 : 1-225, 354-80.

This investigation forms part of an enquiry into the function of money and products in relation to native diet and physical condition in Koetowinangoen, Java. Two other papers relating to this enquiry are dealt with in abstracts Nos. 116 and 117 of this issue. The yards [or gardens—there is no exact English equivalent for the native name.—Ed.] lying immediately around the houses are densely planted with fruit trees and all other crops which can be grown in combination with them. These yards take up 15% of the arable land in Java and provide about 50% of the daily menu. In Koetowinangoen, the district investigated, the remaining requirements, with the exception of such luxuries as cabbage and onions, are provided by the local agriculture, so that the entire area is practically self-supporting. Comparison is made between the values (both food and cash) of the crops produced on the sawahs or irrigable rice fields, the telegans or non-irrigable fields which produce rapidly maturing crops, and the compounds. It is shown that in order to safeguard a sufficient food supply attention must be paid to improved production of those crops which could cause an increase in the total of the proteins. The ways in which this could be brought about are discussed.

116. DONATH, W. F. 63 : 613.2
 De voedingswaarde van het inheemsche menu de Koetowinangoen. (**The chemical constituents and food values of the native diet.**) [Dutch-English summary.]
Landbouw, 1934, 10 : 227-309, 381-98.

A careful investigation has been made into the food values of the diet consumed by the native population of the district of Koetowinangoen, Java. So far as can be seen the diet is not insufficient, though there seems to be an unfavourable relationship between the vegetable and animal proteins and the low amount of animal fats which include also the lipoids. Sufficient calories are obtained by the use of large amounts of carbohydrates. It has not yet been determined whether the diet contains sufficient vitamins and mineral salts, though the probability is that it does.

117. DE LANGEN, C. D. 63 : 613.2
 De gezondheidstoestand van de bevolking te Koetowinangoen. (**The general state of the inhabitants of Koetowinangoen.**) [Dutch-English summary.]
Landbouw, 1934, 10 : 335-51, 399-416.

This paper is the third and last of a series on the results of a recent investigation into the diet and physical condition of natives of a district in Java. The general state of health appears to

be reasonable and no definite under-nourishment is evident, though the weight of the persons studied appears to be on the low side. Blood pressure was universally low and is probably attributable to the insufficient amount of proteins consumed. There is also an insufficiency of fats in the diet. Viewed from a European standpoint the poorer families must be considered as living on the borderline of what is essential for the human organism.

118. CALINISAN, M. R. 633.522-2.8

Notes on a suspected "mosaic" of abaca* in the Philippines.

Philipp. J. Agric., 1934, 5 : 255-6.

A mosaic-like disease of abaca (Manila hemp) hitherto unreported in the Philippines is described. With some minor variations it appears to be similar to if not identical with the new virus disease of bananas reported by Magee in New South Wales (*Agric. Gaz. N.S.W.*, 1930, 41 : 929), though, contrary to experience in N.S.W., attempts to transmit the disease by inoculation have in the Philippines so far proved abortive. The disease is spread in the field by planting infected suckers, and apparently it can be controlled by roguing and burning mosaic-infected plants. Its effects are slight as compared with abaca bunchy top and stem rot, but it seems to affect the normal growth of the plant and may thus reduce yield.

119. AGATI, J., AND OTHERS. 633.522-2.48

Further studies on the stem rot of abaca in the Philippines.

Philipp. J. Agric., 1934, 5 : 191-208, bibl. 18.

The fungus *Helminthosporium torulosum* (Syd) comb. nov. Ashby is in constant association with stem and fruit necrosis on abaca and bananas respectively. The disease is favoured by prolonged dryness owing to the then weakened condition of the plant. The optimum temperature for development of the fungus seems to lie between 25° C. and 30° C. Constant roguing of diseased plants and irrigation during prolonged drought will partially reduce the disease, as will the growing of efficient shade in dry places to prevent the rapid drying of the soil. An attempt to develop a resistant strain from local varieties is considered preferable to the import of numerous varieties whose resistance under Philippine conditions is an unknown quantity.

120. McDONALD, J. A. 633.74-1.8

The mineral nutrition of plants. The possible application of recent ideas to the growth and manuring of the cacao tree.

Trop. Agriculture, 1935, 12 : 11-5, bibl. 28.

The possible application of the results of research on the mineral nutrition of deciduous fruit trees to problems concerning the growth of cacao is discussed. Based on these results the following hypotheses are put forward. Shrivelling of the young cherelles may be due to potassium deficiency. This may be linked with the widespread deficiency of soil phosphate shown to exist by the soil surveys. The addition of phosphatic manures to a soil deficient in phosphates has resulted in an increased uptake of potash by the cacao tree. Thus a deficiency of soil phosphate may lead to the tree being unable to secure adequate supplies of potash. The potassium/nitrogen ratio of the leaf may be of great significance in diagnosing the nutrient requirements of the tree. Cacao trees markedly susceptible to thrips show a low potassium/nitrogen ratio in the leaf. Application of phosphatic manures has in certain instances altered this ratio and the change has been associated with a 50% increase in yield. The influence of C/N ratio on fruit production is explained and the fundamental differences in orchard manurial practices in North America and England due to high light intensity and small summer rainfall on the one hand and a lower light

* Abaca is *Musa textilis* Née, Manila hemp, and furnishes one of the most valuable fibres for rope making.—ED.

intensity and abundant summer moisture on the other is pointed out. On this analogy it is possible that there may also exist fundamental differences between the manurial ratios required in Grenada where the cacao is grown without shade and in Trinidad where heavy shade is used.

121. KADEN, O. F.

633.74-1.542

Der Schnitt des Kakaosbaumes und sein besonderer Zweck, die Krankheitsverhütung. (*Cacao pruning and its aim, the prevention of disease.*)

Tropenpflanze, 1934, 37: 459-69, bibl. 6.

The author considers that much the best method of dealing with the cacao tree is to allow it to fork once only. This should be allowed to take place not less than, say, 30 inches from the ground. Three or four main branches can here be formed and these should furnish an adequate tree spaced at about 4 to 5 yards from tree to tree. Pruning should then aim at the removal of all shoots or growth which obstruct the normal growth of the main branches. At the top of the tree enough subsidiary shoots should be left to form that complete shade which is essential. This canopy should be as level as possible and should thereby discourage thrips and other pests. Such fruit bearing sideshoots as are dragged down from the crown close to the ground are a source of infection by *Phytophthora Faberi* and should therefore be removed. Once the trees are mature they will only need structural pruning every 2 or 3 years and this should not entail the removal of more than $\frac{1}{5}$ of the crown at a time. Apart from this all that will be necessary is the cleaning off of the dry wood and of unnecessary shoots each year. Pruning should take place either shortly after harvest or, if weather makes this impossible, just before the next blossoming. Trees should not be in flower at the time of pruning; they should be quite dry, not moist from dew or rain. Disregard of this precaution leads to canker and branch withering. Shoots from the base of the trees should be removed except where it is necessary to replace the tree by reason of age or disease, when their superiority over ordinary young plants in speed of development into bearing trees makes it advisable for them to be left to replace the present tree. Such shoots will grow quickly and the old tree must be cut off at the base before its crown can impede the new tree. All cuts must be clean, as they will otherwise fail to heal and will prove sources of disease infection. There must be no opportunity for water to collect on the cut surfaces. At the time of this annual pruning all unnatural growth due to parasitic action should be removed and moss and climbing plants should also be eliminated by brushing, cutting or spraying with some form of bordeaux. Where witches broom is present, caused by *Marasmius perniciosus* Stahel, the affected areas should be cut out and burnt. Where, moreover, the cacao moth or various *Helopeltis* pests are known to be in the district, a careful watch should be kept for their eggs, which should be destroyed. A few lines only are devoted to pruning standard trees and trees possessing several stems.

122. VON BERNEGG, S.

633.7

Le Guarana.

Rev. Bot. appl., 1935, 15: 49-50, from *Tropische und subtropische Weltwirtschaftspflanzen*, 1934, 2: 265-73.

Guarana is an alimentary paste prepared by the Indians of northern South America from *Paullinia Cupana*, a sapindaceous tree found in N. Brazil. The seeds are not long viable and propagation is usually by cuttings. The tree lives about 40 years, producing 2 kg. of fruit per annum. To prepare the paste the beans are deprived of their tegument which contains a certain amount of saponin and are then crushed in a mortar. The pulp is mixed with cassava flour and is kneaded into a kind of bread which is fermented in water after being wrapped in palm or banana leaves. This fermentation is to eliminate a part of the tannin and caffeine contained in the seed. The paste is then dried in the sun and is used as a form of gruel. Used fresh the paste makes a drink known as mandioca beer. On the Amazon fermentation is dispensed with. The seed is pulverized, fortified by a number of other ingredients, dried in the sun, and rolled into long cylinders in which form it reaches the market. This preparation contains more caffeine than the fermented kinds. In addition to its alimentary properties it is medicinally used in cases of dysentery. There is a small market for it in Europe.

123. KVARAZKHELIA, T. K.

633.72-1.535

Vegetative propagation of the tea plant. Propagation by cuttings.*

Trop. Agriculturist, 1934, 83 : 261-6, 362-4.

Root cuttings were obtained by uncovering part of the roots of the parent plant and removing the required pieces, or by digging up the plant and cutting up the roots into pieces 7-10 cm. long. The number taken ranged from 20-16 per bush according to its age and vigour. They were planted in the open 20 cm. apart. Thick root cuttings (diam. 2 cm. and over) gave 52-72% success, medium cuttings (diam. 1 cm.) 37-45%, and thin cuttings (diam. under 1 cm.) gave 9-5-18%. The roots of root cuttings planted horizontally spread near the surface of the soil, those planted vertically had a deeper root system. In two or three years with either method of planting some of the horizontal shoots changed their direction and grew vertically. Stem cuttings of numerous types were planted in solar propagators and hot houses. The highest percentage of rooting, 66-70%, was obtained with mature brown cuttings of the current year's growth having 4 eyes and entire leaves, green cuttings similarly equipped giving 31-46%. If shoots having a less number of buds than 4 were used, the percentage of success decreased with the number of buds. It is mentioned that these cuttings were all rooted under unfavourable conditions in many ways and that improved conditions should bring improved results. The cuttings when planted out developed good root systems and the rate of growth for the whole plant was equal and often better than that of seedlings. Buds with one leaf from green or brown wood gave 35-33% success. Grafting and budding were tried both in the field in summer and under glass in winter. In the field the most successful budding method (53%) was a shield bud in which $\frac{1}{3}$ of the leaf blade was left with the bud. When the wood was removed from the eye the take was only 5-3%. Grafting a green scion consisting of 2 eyes and $\frac{1}{2}$ a leaf obtained 52% success, the same, but omitting the leaf, nil. Green scions having 1 eye and 3 eyes were moderately successful, brown scions markedly less so. The author mentions that good stocks were lacking, scions were weak and the bark of the stock was difficult to separate from the wood. Under glass "English" bench grafting gave 76% and saddle-shaped bench graft with tongue 61.5%, bench grafting on roots gave 31.5%. The best stocks for field budding and grafting are vigorous shoots 8-10 mm. thick. Stocks older than three years gave a low percentage of success. In northern and mountainous districts where some of the Assam hybrids do not bloom they can be induced to do so when grafted on northern varieties. This is important in hybridization work when it is required to cross the southern Assam forms with the hardier Georgian and Japanese types.

124. KADEN, O. F.

633.73-1.542

Erfahrungen im Kaffeeschnitt Westafrikas. (Experiences in pruning coffee in West Africa.)

Tropenpflanzer, 1934, 37 : 367-78, bibl. 7.

The author describes and strongly advocates the use of what he calls the old West African method of pruning coffee trees, both *robusta* and *arabica*. Preferably just at the beginning of the rainy period, when the plants are some 1.2 metres high in their second year the stem is bent over. With one hand the stem is held just above ground level, while with the other it is bent over so firmly that after release it will remain at an angle of 45 to 60. Those trees which persist in reassuming an erect habit after a few days must be tied down. The bending is done in that direction from which most of the sun's rays come, so as to avoid direct sunlight reaching and harming the undersides of the leaves. Of the shoots which form after a time at the bend all but two are removed in the first year. In following years it may be expedient to leave one only. By this method it is possible to produce a continual supply of bearing stems without exhausting the tree in any way. The original stem which is forced by the process of bending into generous fruit production soon becomes weak, and may be cut back after a year or two. Meantime the two first bearing stems will have come into full bearing. On their exhaustion they can in turn

* See *Ibidem*, 83 : 199-211, *H.A.*, 1934, 4 : 4 : 635, for an account of layering methods by the same author.

be removed, since new ones are formed yearly capable of taking their place. This results in the plant always remaining young and there being no failure to crop owing to pruning. The proper number of stems to leave depends of course on fasciation and on soil. With *arabica* 3 to 5 would be a usual number, while *robusta* with its stronger root system would stand up to 7 and more. On reaching 2.5 to 3.0 m. high the stems are topped by the Dutch "Smeroe" method. Pruning is then carried out in the woody part close under a node. One of the two highest side shoots is then removed at the node which lies immediately beneath. This will prevent splitting of the top of the stem and will also appreciably check the formation of suckers and shoots. It also tends to produce good fruits, inasmuch as the chief stems bend away from one another and so afford the entry of light and air into all parts of the tree. Further pruning consists of the removal of dried up wood and unwanted suckers and shoots. A secondary pruning recommended by Yglesias may or may not be advisable. It consists of shortening exhausted branches at the first or second node, to induce them to make further shoots and bear more abundantly. The danger is that the excessive bearing thereby induced may lead to the early death of the trees and caution is therefore necessary. The author considers that it should be possible to change existing coffee trees pruned in other ways and not yielding satisfactorily over to this West African method chiefly by utilizing new suckers and slowly removing the present structure. He says that the adoption of the method has led in the last few years not only to a considerably increased crop, but also to a surprising decrease in disease. In S. Tomé, for example, it has led to a marked check to the *Hemileia* disease and to the damage done by nematodes. He considers that the Agobiada or the Costa Rica (candelabra) methods of pruning would probably have equally good results but necessitate much more expert workmen than does the method described above. Diagrams are shown illustrating the method.

125. NUTMAN, F. J.

633.73 : 581.144.2

The root-system of *Coffea arabica*.

Amani Memoirs (undated received Jan., 1935). Reprinted from *Emp. J. exp. Agric.*, 1933, 1 : 271-96, bibl. 9.

Part I describes and illustrates coffee root systems in typical soils of 13 areas of British East Africa. The root systems were exposed by digging a trench beside the tree and washing away the soil by means of a jet of water provided by a powerful centrifugal pump driven by a petrol engine. The trees studied were 6-8 years old. In all areas the coffee appeared to have fully developed its root system 5-6 years from planting, by which time extension growth of the main roots has practically ceased. II. The effect of some soil conditions in modifying the normal root system. The author describes what he considers to be a "normal" root system of *Coffea arabica*. The description is a detailed one, sub-divided under the heads—"Tap-root" : not the type usually connoted by this term but a stout, central, often multiple, root frequently terminating abruptly and rarely recognizable more than 1 ft.-1 ft. 6 in. from the surface. *Axial roots* : 4-8 in number, running vertically downward for 8-9 ft., being either laterals that have turned downwards or forks from the tap-root, much branched. *Lateral roots* : (a) surface-plate roots more or less parallel to the soil surface for 4-6 ft., branching horizontally, evenly and sometimes vertically ; (b) laterals not in the surface plate, deeper than the preceding and not running horizontally to the soil surface, branching in all planes. *Feeder bearers* : of varying lengths, evenly distributed at 1 in. apart on the permanents with a slight tendency to be shorter and more numerous in the surface soil. Feeders are borne uniformly on the feeder bearers being slightly more numerous in the surface soil. It is then shown how this normal type of root system is modified by different types of soil. As regards pH a neutral or slightly acid soil with a limit of acidity of about pH 5.8 appears to be the most favourable for root growth. Cultivation injuries, if moderate, will be repaired in healthy trees and the regeneration may even improve the root system. This does not mean that such cultivation methods are to be advocated. "Die back" of the roots is attributed to overbearing with a resulting deficit of carbohydrate. No regeneration has been observed in these cases. Suggestions are given for manurial treatment of trees affected by this trouble.

126. PYKE, E. E., AND OTHERS. 633.74-1.521.5

On the variability of cacao seeds after storage.

Trop. Agriculture, 1934, 11 : 303-7.

The exigencies of cacao research work often require the transportation over long distances of pods containing seeds for sowing. These seeds must arrive in perfect condition and be capable of germinating and producing strong plants. A random collection of freshly picked pods from River Estate was divided into lots of 3 pods and held at temperatures of F. 80°, 70°, 60°, 50° and 45° for periods of 10, 20, 30, 40 and 50 days, while others were held at 80° F. and 70° F. and subjected to various antiseptic treatments. The antiseptic treatments did not materially check the development of latent or incipient infections, but an even coat of white vaseline with or without 2½% carbolic acid or steeping for 15 minutes in 0.2% solution of mercuric chloride before smearing with vaseline would appear to be efficacious in reducing water loss. The most suitable temperatures appeared to be between 60° F. and 70° F. Chilling below 60° F. even for short periods is harmful. The pods used must be free from all abrasions or other blemishes likely to become infected particularly in the depression at the junction of the pod and stem. The pods should be gathered just before they are fully ripe. Owing to the unpredictable wastage seed samples for sowing should consist of not less than 5 and preferably of 10 pods.

127. SOLIVEN, F. A. 633.85 : 581.192

The proximate chemical composition of the seed and oil of Philippine oil-bearing seeds. I. *Pongamia pinnata* Merr.

Philipp. Agric., 1934, 23 : 576-87, bibl. 4.

Literature on the chemical composition and oil of *Pongamia pinnata* Merr. is wanting, though the oil of *P. glabra* has been studied. The tree is a member of the *Leguminosae* and is found wild in the Philippines. The kernel was found to contain 26.63% of a yellowish-orange oil. The cake derived from the extraction of the oil might be used as food for livestock, as the amount of carbohydrate and protein constitutes more than 50% of the kernel. The oil is composed of 76.96% liquid acids and 23.04% of solid acids. The liquid acids are composed of 14.69% oleic acid and 85.31% linoleic acid expressed on the basis of the original oil. Oleic acid predominates in the oil of *P. glabra* while linoleic acid predominates in *P. pinnata*. The results of the analyses are set out in nine tables.

128. DECARY, R. 633.88.32.491

Le ricin dans l'extrême sud de Madagascar. (The castor oil plant in the extreme south of Madagascar.)

Rev. Bot. appl., 1934, 14 : 1035-7, bibl. 1.

Castor oil (the variety not yet identified) is now the staple crop in the south of Madagascar, where it grows naturally in dense stands along the permanent calcareous dunes of the littoral. The seeds are harvested in June and also in October and November, at which latter period most of them are ripe. Two qualities of these are recognized according to whether they have been picked off the plant or allowed to fall on the ground. In the latter case the value is depreciated, but it is almost impossible to prevent the natives mixing the two qualities together with a resulting lowering of price. It has also been impossible until recently to get them to trouble to cultivate a plant which grows wild in such abundance, but there are signs that they are now beginning to understand the advantages that this would bring them. The minimum purchase price from the grower should be 40 centimes per kilo. The larva of a small moth has done considerable damage in the past by eating the flower heads.

129. MURRAY, R. K. S. 633.912

Field experiments on Dartonfield Estate. I. Replanting.

Rubber Research Scheme, Ceylon, 3rd and 4th quart. circ. for 1934, pp. 56-63.

The objects and design of the experiments to be carried out on the Scheme's recently acquired Dartonfield Estate are to be described to the planting public in the pages of the Quarterly Circular as they are initiated. The first experiment provides for the following comparisons.

(a) *Removal of timber.* Comparison of costs, growth, and disease incidence under the following treatments, all trees being felled by elephant :—(1) leaving large timber unburnt, (2) burning all timber *in situ*, (3) as (2), but removing and burning all large lateral roots. (b) *Species of cover crop.* Those to be tried are *Centrosema pubescens*, *Pueraria phaseoloides*, *Calopogonium mucunoides*, *Dolichos Hosei*. (c) *Control of cover crops.* (1) Clean weeding, (2) a 6 ft. circle to be kept clean round each plant. In the progress report here issued a summary of the work done from November 27th, 1933—September 30th, 1934, is given. The various operations are described and the cost is given. At the end of the article an estimate of representative costs for a first year of replanting is given based on the experience of these operations. Where the exigencies of experimental treatments have raised the costs abnormally, the figures have been modified to bring them into line with estate conditions.

130. HAINES, W. B.

633.912-1.874

The uses and control of natural undergrowth on rubber estates.

Rubber Res. Inst. of Malaya, planting manual 6, 1934, pp. 23 + 20 pp. figs.

The practice of clean weeding which was formerly considered of so much importance on rubber estates is falling into disrepute and the tendency now is to allow a natural but controlled undergrowth. The advantages of the use of such natural covers are :—The reduction or prevention of soil erosion, the reduction of excessive run off of rainfall, the reduction of soil temperature, an increased supply of humus and consequently of the water absorption capacity of the soil. This bulletin discusses the ecological aspect of the situation. The most suitable cover plants are those of sappy tissue, high in nitrogen, with feeding habits as different from rubber as possible. Deep rooting is desirable to break up the soil, though there is no special objection to superficial rooting, unless the plant is sensitive to the competition of the rubber tree roots near the surface. Full page line drawings are given of 20 of the most common plants of the undergrowth. These are classified as :—Class A, to be encouraged in any circumstances. Class B, useful on the whole but requiring more or less control according to circumstances. This class will later be subdivided as experience and knowledge of their degrees of usefulness extends. Class C, plants which have on the whole undesirable characters. Some of these may be permitted in the early stages when no alternative offers. It is proposed to publish in due course a full list of common plants of the undergrowth with drawings and descriptions.

131. WEST, E.

634.441 : 632.482

Anthracnose of mango.

Press Bull. Fla. agric. Exp. Sta. 463, 1934, pp. 2.

Anthracnose caused by the fungus *Colletotrichum gloeosporioides* Penz. is the major factor directly limiting the mango crop in Florida. The disease attacks all the more tender portions of the mango tree including flowers and fruits. It appears in the form of small black or dark spots on the stems, leaves and flower stalks. It spreads rapidly, flowers and flower stalks wither, and the fruiting of the tree may be entirely prevented. With lighter infections on the flower clusters some fruit may be set, but later the disease will spread to the peduncles and the fruit will drop. Ripe fruits are also attacked and destroyed. To control the disease about 8 applications of bordeaux 3-3-50 with a calcium caseinate spreader are needed. The first 3 applications are made to protect the flower clusters, the last 5 to preserve the newly set fruit. The programme is spread over 64 days beginning when the flower buds swell and thereafter at the following intervals in days :—4-4 (omit if $\frac{2}{3}$ of flowers in the clusters are open)—7 (apply 3 days earlier if preceding spray has been omitted)—7-7-14-21.

132. JAGOE, R. B.

634.6 : 581.162.3

Observations and experiments in connection with pollination of oil palms.

Malay. agric. J., 1935, 22 : 598-606, bibl. 22.

It is concluded that oil palms are for all practical purposes entirely wind pollinated and that the amount of naturally wind borne pollen is sufficient to provide optimum results on large

plantations where the inflorescences are sufficiently exposed. This is not the case with short-stemmed young palms whose inflorescences are effectively screened by the dense crown of leaves, resulting in light pollination. The possibility must not be disregarded that this screen of leaves may serve as a natural protection against over pollination. An exposure in February in a plantation at Kuala Lumpur of slides coated with 4 parts egg albumen and one part glycerine showed a deposition of pollen of 94 grains per square inch over a period of 3 days which is the length of time a female flower is receptive. Slides coated with 3 parts glycerine to 2 parts egg albumen were exposed in the larger plantations at the Central Experiment Station, Serdang, in November, and in July on another large estate consisting of exposed undulating land. At these times male inflorescences were more numerous than in the case of the Kuala Lumpur experiment. The pollen counts were 109 grains per square inch in 3 days at Serdang and 167 per square inch on the estate. Pollination by insect visitors is probably largely accidental and unlikely to be significant.

133. FREIRE, L.

634.61

A cultura do coqueiro. (*Cultivation of the coconut.*)*Bol. Agric. Zootech. Vet. Minas Geraes, 1934, 7 : 285-90.*

An account of the cultivation of the coconut in Brazil, or rather, an account of the way in which the author would like to see it carried out. Much of this is accepted practice everywhere, and only points which seem of particular interest have been selected in this abstract. Coconuts being raised from seed, the choice of this becomes important. It should be taken only from vigorous high yielding trees 25-40 years old. The nuts should be round, seasoned and fully developed and should be picked and exposed to the sun for 20 days before sowing. As an undercrop cassava, maize and beans may be grown. Plants of an oily nature should be avoided, as their nutritional requirements are the same as those of the coconut. The cassava is recommended because its tubers render the soil permeable, it requires to be kept clean, it shades the young coconut roots and conserves the soil moisture, and in addition contains a large amount of nitrogen. The statement that cassava impoverishes the soil is contested and instances are given of serious drought when the only coconut groves which maintained their normal healthy appearance were those carrying an undercrop of cassava. The nuts from these groves received the premier award in the National Society of Agriculture's Exhibition the following year for the finest produce in Brazil. Organic manure is highly beneficial and this may take the form of night-soil, stable manure and various parts (stems, leaves, etc.) of the cassava. Common salt is necessary to maintain a high yield. This is best given mixed with a green manure. The leaves of the mangrove form a valuable salty fertilizer.

134. DE VERTEUIL, J.

634.61-1.8

*Manurial experiments with coconuts on Perseverance Estate, Couva.**Trop. Agriculture, 1934, 11 : 313-5, bibl. 1.*

A manurial experiment with coconuts is described in detail. There were 9 different manurial treatments, comprising complete fertilizer and pulverized limestone, both separately and in combination with one another, with two different amounts of each, together with a no manure, or control, treatment. Each treatment was replicated 4 times. The number of nuts per tree was recorded for three years, 1931-33, and the figures were analysed for each year separately. The large tree-to-tree variability obscured any possible manurial effect in 1931 and 1932, but in 1933 both lime and artificials had a significant effect upon the yield. It is evident that 10 tons of lime per acre was as efficient as 20 tons, and 9 cwt. of artificials as efficient as twice that quantity. Both lime and artificials caused their respective increases in yield entirely independently of one another. In both cases no increase in yield was evident until two years after application. Actually the yield following the application of lime 10 tons plus 9 cwt. complete fertilizer (2 cwt. sulphate of ammonia, 5 cwt. superphosphate, 2 cwt. sulphate of potash) per acre was 74.75 nuts per tree as compared with 40 nuts per tree from the control plot.

J.L.E.

135. WEST, E.

634.651 : 632.4

Papaya leaf spot.*Press. Bull. Fla. agric. Sta.*, 462 : 1934, pp. 2.

The disease which is especially dangerous to young plants is caused by the fungus *Pucciniopsis Caricae*. The symptoms start with a pale spot on the underside of an expanded leaf which eventually becomes visible on the upper side. The fruiting bodies appear on the undersides and are often arranged in many concentric rings within the spot. Control consists in removing and burning infected leaves and spraying with bordeaux mixture 3-3-50 with calcium caseinate as a spreader once a week until all signs of the disease disappear. The disease should be checked immediately on appearance before the plants bear fruit, since the fungicide stains the fruit which, owing to its soft skin, cannot be cleaned.

136. MARIANO, C. O.

634.669-1.8

Effects of fertilizers on the growth and development of young lanzon plants (*Lansium domesticum* Correa).*Philipp. Agric.*, 1934, 23 : 613-38.

The object of the study was to find fertilizers that would promote a more rapid growth and development in young lanzon plants. In the ordinary way the tree does not bear until it is 12-15 years old and as the fruit is of high commercial value any improvement bearing on the ultimate yield of the tree would be of importance. The plants were raised from seed from one tree. There were 7 main experiments, 5 being on plants grown in pots in tuff soil, and 2 in clay loam. Subsidiary experiments were carried on within certain of the main ones. Each was replicated several times. It was of course not possible to use the fruit as a criterion in a short term experiment, the fresh weight increase in number of leaves and increase in height being used instead. It was found that the young lanzon plant when grown in tuff soil was most benefited by a relatively large amount of nitrogen and phosphorus but when grown in clay-loam soil phosphorus and phosphate alone was the principal growth promoting ingredient. All cultures supplied with nitrate of potash only were much inferior to cultures supplied either with ammonium-phosphate 13-48 or sulphate of ammonia. The results are tabulated in detail.

137. DE WILDEMAN, E.

634.771/3 : 581.46

Morphologie florale des Musa. (Floral morphology of Musa.)*Rev. Bot. appl.*, 1934, 14 : 925-30.

The author considers that as a race the *Musae*, particularly the edible bananas, are entering on a regressive condition which he terms "advancing sterility". He traces the morphological changes by which this is gradually being achieved. He considers that the phenomenon should be carefully studied particularly in its bearing on a possible resulting reduction in fruitfulness.

138. HICKS, E. W.

634.771/3-2.1

Finger dropping from bunches of Australian Cavendish bananas.*J. Counc. sci. industr. Res. Aust.*, 1934, 7 : 165-8.

When the results obtained by Young* and others in their investigations into the ripening of bananas were put into commercial practice a tendency to finger dropping arose, i.e. individual bananas become detached from the bunch as a result of fracture of the peel, part of which is frequently torn from the pulp as the bananas fall. It has now been found (as a result of a special investigation financed by the Commonwealth Banana Committee) that this finger dropping is caused by excess of humidity in the later stages of ripening. The maximum humidity should be 70%. It is not possible adequately to reduce the humidity in closely packed commercial ripening rooms. Alternative measures which have reduced the tendency are early removal of the fruit from the ripening rooms or the storage of the green bunches for several days at a relatively low temperature a few days before ripening is begun. The former method requires a great deal of extra storage room, the latter could not be carried out economically in summer when artificial cooling would be necessary.

* Young and others. Ripening and transport of bananas in Australia. *Bull. Counc. sci. industr. Res. Aust.*, 64, 1932. *H.A.*, 1932, 2 : 4 : 304.

139. ALONSO, C. S. 631.874

A test of some green manure crops.

Philipp. Agric., 1934, 23 : 543-58, bibl. 18.

The objects of the study were (a) to discover the comparative values of nine green manure crops in the Philippines, (b) to determine the quantity of dry matter they produce, (c) to analyse them for values of N_2 and P_2O_5 in the different stages of growth and development under field conditions. The species used were *Tephrosia candida*, *T. noctiflora*, *Crotalaria juncea*, *C. usaramoensis*, *C. anagyroides*, *Indigofera hendecaphylla*, *Phaseolus aureus*, *Vigna sinensis*, *Calopogonium mucunoides*. Most of the information obtained is tabulated under the following heads. (1) Number of days from sowing to flowering and to maturing. (2) The average length of roots and stems and the yield of fresh matter in kilograms per sq. m. (3) Results of turning under green manures to a depth of 30 cm., examined at 14 day intervals. (4) Relative chemical composition in terms of percentages calculated on oven dried samples. (5) Comparative yields of fertilizing materials calculated in grams per sq. m. of fresh matter. The records are shown for every month of growth from 2-6 inclusive except for *Vigna sinensis* which was from 1-2½ months. Table 3 shows that within four weeks the green manures turned under had all been eaten by white ants with the exception of *Calopogonium mucunoides* and *Indigofera hendecaphylla*. Further tests indicated that these plants were definitely distasteful to the ants. *Indigofera* has to be buried more deeply than the others or it will sprout and root again. *Crotalaria usaramoensis*, *C. juncea* and *Tephrosia candida* are high nitrogen yielders. *Calopogonium mucunoides* was a low yielder for 3½ months but the highest at 5 months. *Indigofera hendecaphylla* was low in nitrogen throughout. Large quantities of phosphorus were found in all plants at the ages of four to five months.

140. CROUCHER, H. H., AND MARTINEZ, R. S. 634.61 : 631.83

Coconut husk ash as a fertilizer.

J. Jamaica agric. Soc., 1934, 38 : 617-9.

The ash of burnt coconut husks contains 10-25% of available potash. The chemical fertilizer, sulphate of potash, contains about 48% of available potash. Coconut husk ash therefore may have a manurial value from $\frac{1}{4}$ - $\frac{1}{2}$ that of sulphate of potash. The composition of the ash will vary with the conditions under which the husks are grown and the method by which they are burnt. The lower the temperature of firing the richer in potash will the ash be, so that the best method is that of the slow burning heap of husks. The ash must be kept dried when stored as the potash is readily soluble. A disadvantage of coconut ash on heavy clay soil but not on light soils may be that the soda ash which it contains will tend to bind the clay and so impair the tilth. A second disadvantage is that the ash may contain a considerable proportion of chloride or common salt particularly when derived from plants growing close to the sea. Citrus is very susceptible and bananas moderately so to chloride so that coconut ash should not be used for them. Coconuts require the chloride and sugar cane is unaffected by it. An experiment to determine the loss of ammonia likely to occur if the coconut ash was mixed with fertilizers containing ammonia showed that a mixture containing 2 parts coconut ash and 1 part sulphate of ammonia would, if spread on a dry soil, lose 50% of the ammonia in 5 days and if spread on a wet one 80%. The latter condition is equivalent to a loss on a ton of sulphate of ammonia of £6 10s. It is recommended that ammonia-containing manures should be applied at least a fortnight before the ash. Fertilizers not containing ammonia may be safely mixed with coconut ash.

141. SILVA, A. 631.874

As crotalarias. (Crotalarias.)

Bol. Agric. Zotech. Vet. Minas Geraes, 1934, 7 : 293-5.

The uses of the crotalarias of Brazil are discussed. They can roughly be subdivided into 3 classes, tall, medium and low growing. The most useful of the tall varieties are *C. anagyroides*, *C. juncea* and *C. usaramoensis*. They make a green or dry fodder which is much appreciated by stock or they can be used as a green manure. *C. anagyroides* is particularly useful and can be cut several times a year. All three varieties provide a useful fibre which has many possibilities

in manufacture. Medium sized varieties are *C. aretusa* and *C. striata*. Both produce great quantities of seed. *C. striata* is regarded as being one of the most promising. The third or low growing class are pre-eminently plants of the open country. The best are *spectabilis*, *pterocaulis*, *vespertilio*, *foliosa*, *velutina*, *flavicomis*, *unifoliata*, *Claussenii*, *rufipila*, *incana* and *manupurensis*. As regards pests and diseases in Brazil a boring beetle is particularly destructive to *C. anagyroides*, while *C. usaramoensis* suffers severely from a fungus which has not yet been identified.

142. JOACHIM, A. W. R., AND KANDIAH, S. 631.87
Chemical studies on compost manure.

Trop. Agriculturist, 1934, 83 : 277-93, bibl. 8.

The following conclusions are drawn from the result of numerous analyses of compost manure samples prepared in various parts of Ceylon by different methods and of the chemical investigations on the street night soil composing process adopted by the Medical Department. Compost manures are similar in composition but of a slightly lower manurial value than local cattle manure. Night soil street refuse has the highest and pit compost the lowest manurial value of the types examined. Untreated street refuse is a useful organic manure but of poorer manurial value than treated refuse. Liming was found to be of no advantage in composting, nor was there any in keeping the heaps under exposed conditions for longer than 3 months, after which time there is no appreciable change. A charge of about 15% of night soil is enough to produce a decomposed product of good manurial value. One part decomposed compost to 4 of refuse will ensure satisfactory decomposition in two months.

143. McRAE, W. 633.841-2.4
Foot-rot diseases of *Piper Betle* L. in Bengal.

Indian J. agric. Sci., 1934, 4 : 585-17, bibl. 26.

The betel vine in India is cultivated in a kind of hut composed of reeds or grass woven on to a light framework of bamboo. The vines are grown in rows on ridges and tied to jute stalks for support. The air inside the hut is moist and still and during the monsoon saturated. The water level comes very near the surface which in places is awash for considerable periods. In such an atmosphere even mildly pathogenic fungi may cause considerable damage. The ease with which infection may be spread is thought to be the reason why all persons not members of the cultivator's family are rigorously excluded from the huts, though this is not exactly the explanation given by the grower. This exclusiveness makes it very difficult to obtain accurate information. Recently foot-rot diseases have assumed considerable proportions in Bengal. Several fungi have been associated with the diseased plants, the principal losses being due to *Phytophthora parasitica* and an allied form. Other injurious fungi of less importance are *Rhizoctonia Solani* and *Sclerotium Rolfsii*. The *Phytophthora* can be controlled by spraying the lower stems with bordeaux mixture 2.5-2.5-50 just before the monsoon and three times subsequently at monthly intervals. *R. Solani* can be controlled by spraying with a weak solution of Kerol. Bordeaux mixture is ineffective with this foot-rot. In addition to these sprayings the most successful preventive measures for all foot-rots will probably include growing the vines above flood level and the careful removal of all diseased parts of the plant as soon as they appear.

144. LELE, S. L. 633.841-2.651
Destruction of earthworms.

Poona agric. Coll. Mag., 1934, 26 : 112-3.

Experiments were conducted for six weeks with various types of fertilizer for the destruction of earthworms in the soil and particularly in beds of the betel vine (*Piper Belle* L.). It was found that nitrate of soda was the most efficient and sulphate of ammonia next. The minimum efficient dose used was at the rate of 300 lb. to the acre.

145. MADRID, V. J. 632.951.8 : 631.535 + 631.531
Treatment of seeds and plant cuttings with coal-tar-kerosene emulsion as a protection against certain insects.
Philipp. Agric., 1934, 23 : 604-12, bibl. 5.

Seeds soaked up to one hour and plant cuttings immersed from the base to two-thirds of their length in the following solution were rendered practically immune to the attacks of ants and termites, whereas the controls suffered badly. The mixture proved harmless to plants or seeds. Laundry soap 500 grams, coal tar (without creosote) 5 litres, kerosene 3 litres, water 4 litres. Shave the soap into water and boil until dissolved. Remove from fire and while still hot add kerosene and coal tar which have been mixed in a separate container. Stir till a fairly complete emulsion is formed. An emulsion can be quickly made by beating up the mixture with a small twiggy branch. To use, dilute with water to 10 parts per volume.

The following also are noted :—

SHEPHERD, C. Y. **Agricultural labour in Trinidad.** *Trop. Agriculturist*, 1935, 12 : 3-9, bibl. 23. A series of notes on agricultural labour in Trinidad, from 1492-1934.

BRAIN, C. K. **The weeds and poisonous plants of Southern Rhodesia. Part I.** *Publ. Minist. Agric. S. Rhodesia*, 935, 1934, pp. 13.

POISON PLANTS COMMITTEE. **Some important poison plants of North Australia.** *Pamphl. Counc. sci. industr. Res. Aust.*, 49, 1934, pp. 44.

STICKNEY, F. S. **The external anatomy of the *Parlatoria* date scale.** *Tech. Bull. U.S. Dep. Agric.*, 421, 1934, pp. 67., bibl. 14.

PHILLIPS, J. S. **The biology and distribution of ants in Hawaiian pineapple fields.** *Bull. Pineapple Producers Co-op. Assoc. Ltd. Exp. Sta. Hawaii*, 15, 1934, pp. 57, bibl. 61.

STORAGE.*

146. ADRIANO, F. T., AND TABIJE, D. P. 664.84/85
The relative efficacy of different storage solutions for the preservation of natural color in Philippine plant material for exhibition purposes.
Philipp. J. Agric., 1934, 5 : 157-68, bibl. 9.

Fifteen formulae for preserving or storage solutions are given and 2 fixing formulae, with instructions for use. A table of 64 varieties of fruit or vegetables is given showing the most satisfactory solutions for each in order of merit. Solutions giving unsatisfactory results for any particular plant are also noted. It is not indicated whether these formulae preserve the colours indefinitely or whether they require occasional renewal to remain effective.

147. TOMKINS, R. G. 664.85.038 : 546.15
Iodized wraps for the prevention of rotting of fruit.
J. Pomol., 1934, 12 : 311-20, bibl. 2.

The writer notes that to prevent growth of mould on the surface of fruit any wrappers used must be impregnated with a substance which can diffuse from the paper, reach the surface of the fruit and there inhibit mould growth. Such substances must fulfil certain requirements, viz. :— (1) They must be volatile but only slightly so. (2) Present only in small quantities they must prevent the growth of mould without damaging the fruit. (3) They must not hasten the ripening of the fruit or dissolve in fruit juices with a characteristic taste. (4) They must not render the fruit toxic. Iodine appears to fulfil these needs, at least in some cases. The author describes preliminary tests in the laboratory. Larger scale experiments have now been planned to confirm and extend results obtained there. Laboratory tests have shown the efficacy of small amounts

* See also 44.

of iodine. Grapes and tomatoes were kept free from rots or fungal growth for longer periods when wrapped in iodine treated paper than when wrapped in untreated paper, and their appearance and flavour were in no way impaired. The rotting of apples and plums and peaches was also reduced by similar wrapping, but the appearance and ripening of some varieties of these fruits was adversely affected.

148. MALLISON, E. D., AND POWELL, C. L. 664.85.13.037 .

Refrigerated transportation of Bartlett pears from the Pacific Northwest.

Tech. Bull. U.S. Dep. Agric., 434, 1934, pp. 29, bibl. 6.

Pre-cooling pears prior to transport enabled them to be brought to market in just as good condition when shipped in 720 box loads as in 520 box loads. It was found that putting 75 or 50 lb. salt on the ice at each icing station produced lower and more uniform temperatures and was more effective in retarding ripening than the application of 3% salt (i.e. 3% in weight of ice required to fill bunkers to capacity and the same percentage of the ice added at each re-icing station). Bartlett pears picked at the proper stage of maturity can be shipped at an average temperature as high as 41° to 43° F. for the 10 to 12 days necessary to reach markets and afterwards remain in good marketable condition after 2 months storage at 32°. If wanted for immediate consumption they can be transported at an average temperature of but not exceeding 50° F.

149. CAMPO, J. H. 664.85.431

Studies of the storage temperature requirements of the chico, *Achras Zapota* Linn.

Philipp. Agric., 1935, 23 : 706-15, bibl. 13.

Under ordinary conditions fruit of the chico (*Achras Zapota*) cannot be eaten till ripe and its market life is only two or three days. Of the temperatures used in the investigations 15° C. for green and turning fruits kept them in good condition for an average of 17-18 days. Ripe chicos kept in good condition for 12-13 days at 0° C. Green and turning fruit stored at 0° C. for not more than 5 and 6 days ripened normally when moved to room temperature 27°-30° C. (80°-6°-86° F.). If left longer than 8-10 days in temperatures 0° C.-10° C. they failed to ripen on removal. Catalase activity became faster as the temperature increased and there appeared to be a close parallelism between the decrease in catalase activity at low temperatures and the failure of the fruits to ripen.

150. BROOKS, C., AND HARLEY, C. P. 664.85.11 : 632.19

Soft scald and soggy breakdown of apples.

J. agric. Res., 1934, 49 : 55-69, bibl. 12.

The paper deals with the effect of pre-storage treatment of apples upon the later development of soft scald and soggy breakdown, with incidental data on internal breakdown. Soggy breakdown differs from soft scald in the fact that in its earlier stages it may not be visible on the skin of the apple but first affects the cortical tissue at a depth of $\frac{1}{4}$ - $\frac{1}{2}$ inch. The affected tissue is seen to be sharply defined from the remainder of the apple. In this it differs from internal breakdown and old age disease of the apple in which the affected tissue is not so sharply defined and is usually mealy rather than soggy. Both soft scald and soggy breakdown are greatly increased by delayed storage, the extent of the increase usually varying with the period of delay. Soggy breakdown but not soft scald was somewhat decreased by a gradual cooling of the fruit before storage. Accumulated soft scald tendencies were largely dissipated by coating the fruit with a mixture of oil and paraffin, or by short period pre-storage exposure to partial vacuum or to a high temperature 95°-110° F. or to carbon dioxide gas. Carbon dioxide treatments produced a similar response in accumulated soggy breakdown. Carbon dioxide may form the basis for practical control of these two diseases when fruit is held at 32° F.

PACKING, PROCESSING, FRUIT PRODUCTS.

151. EASTWOOD, H. W. 634.771/3-1.56
Will banana growers revert to packing in "hands" and "clusters"?
Agric. Gaz. N.S.W., 1934, 45 : 704-6.

A discussion of the relative advantages of 3 different methods of packing bananas. The packs are illustrated by photographs. Packing the fruit in singles is the usual method for the Australian market and is favoured by salesmen solely because it is a good count pack containing two or three dozen more fruit per case in comparison with fruit packed in hands or clusters of three. There is, however, ample evidence that the consuming public is more attracted by fruit in hands or clusters. The lower price that these packs bring to the grower should be compensated by the reduced cost of packing, the reduced wastage from the diseases which are favoured by singles packing, and by increased sales. An instance is given of a Sydney retailer who increased his sales up to fifteen cases a week by displaying fruit packed in hands. Points to observe in packing bananas:—Only well filled fruit should be cut; immature fruit will never look attractive. When singling care should be taken not to twist the fruit at the stalk end or in any way damage the shank. Carelessness in this respect is responsible for most of the "black end" that develops in packed singles. Every bruise, though unapparent on the green fruit, shows up as a black mark when the fruit yellows. Sap stain also discolours fruit.

152. POULTNEY, S. V. 634.11-1.57
Apple preparations.
Food Manuf., 1935, 10 : 14.

Recipes are given for making apple chutney, apple sauce and apple butter in commercial quantities but without the use of special appliances except a steam coil and a chopping or pulping machine. It is claimed that the preparations are all very palatable, easy to prepare and low in material and production cost, yet will usually fetch good prices.

153. WOLFF, G. F. 663.3
Apple wine.
Fruit Prod. J., 1935, 14 : 176-7, 189.

In this article, the first of a series on the subject of apple wine, the most suitable kinds of apples to use and the peculiarities of the different varieties are discussed. All are American kinds.

154. JOSLYN, M. A., AND CRUESS, W. V. 663.25
Elements of wine making.
Circ. Calif. agric. Ext. Serv. 88, 1934, pp. 64, bibl. 22 (+ 12 books).

During the years of prohibition in the United States the bulletins on the subject of wine making issued by the California College of Agriculture became exhausted and no new ones were published to take their place. The present circular is largely a compilation of the material given in 10 such bulletins or circulars together with information from the latest editions of French, German and Italian books on the subject. It is specially addressed to the beginner and it deals only with dry wine making. It describes the equipment, cellarage, and apparatus necessary for dealing with the grapes from their arrival at the cellar to the finished product including the setbacks that may occur and have to be faced. The best grape varieties for the production of wines are considered, notes being given in many cases of particular characteristics of such varieties. Finally, the lists given of relevant books, journals and equipment manufacturers add considerably to the value of this useful article.

155. MARLOTH, R. H. 634.3 : 667.677 : 547.314.2
Colouring citrus with acetylene.
Fmg. S. Afr., 1935, 10 : 84, bibl. 5.

Satisfactory artificial colouring of oranges was obtained by treatment with acetylene at a concentration of 1 : 1,000. [The author notes that grapefruits and lemons are susceptible to

burn and a concentration of 1:2,500 would be best for them.—Ed.] In the experiments conducted at the Horticultural Research Station at Nelspruit, S. Africa, the treatment lasted for 60 hours and the 20 cu. f. chambers were ventilated and recharged every four hours during the day. Comparable experiments with ethylene carried out at the same time gave a superior colour to the fruit in 30 hours less time and at a concentration about 3 times lower than that required with acetylene. The use of acetylene is not recommended except when ethylene cannot be obtained. It is far more explosive and the presence of impurities in uncertain quantities renders it difficult to determine whether enough or too much gas is present in the chambers for satisfactory colouring.

156. CAMP, A. F., AND STAHL, A. L. 663.815
Preserving orange juice.
Food Manuf., 1935, 10: 86-8, 85.

Preserved orange juice must fulfil the following conditions if it is to become a commercial success. It must be equivalent to fresh juice in taste and quality and contain no added materials, either preservatives or sugar; it must be easier and quicker to prepare for the table than the juice of whole oranges and the price must be reasonable. In the experiments reported here which were carried out at the Agricultural Experiment Station, Gainesville, Florida, 4 methods of extraction were used each giving certain definite peculiarities. The methods were (1) a high speed reamer used on halved fruit, (2) a cup-type press using halved, unpeeled fruit, (3) as (2) but using halved peeled fruit, (4) a worm-type press using peeled fruit. When under-ripe fruit was used a pronounced bitterness of taste developed with those methods of extraction which included particles of segment walls and albedo with the juice. With the reamer method some bitterness developed even in juice of fully mature fruit after two to four days, depending on temperature. On the whole juice extracted from peeled mature fruit by the cup-type press was slightly superior. This kept for 3 days at 32° F. without material change, while at 42°-48° F. some deterioration in quality was noticeable after three days. Terpenous flavours developed rapidly in all juice in which unpeeled fruit was used. Though de-aeration of juice was found to be less important than is usually supposed, there was sufficient effect to justify the practice. De-aeration without gas treatment was compared with treatments with carbon dioxide and nitrogen following de-aeration. The gas treatments gave slightly better keeping quality than de-aeration alone. The nitrogen was slightly inferior to the carbon-dioxide treatment, resulting in a musty flavour after 2-4 days storage. The latter disguised to some extent the off tastes that might develop. Micro-organism development could be checked indefinitely at a temperature of 32° F. and at 40°-50° F. it was held within reasonable limits for 72 hours. The idea underlying this research is that a considerable outlet for surplus oranges would be created, if fresh orange juice which is much used in America could be delivered daily on the doorstep with the morning milk.

157. HILL, H. P. 663.815
Production of alcoholic beverages from citrus fruits.
Fruit Prod. J., 1935, 14: 138-42, 156.

The article shows how surplus lower grade oranges or grapefruit can be utilized in the production of grapefruit wine and brandy. The process and plant are described and tables of costs (in U.S.A.) given.

NOTES ON BOOKS AND REPORTS.

158. CRANE, M. B., AND LAWRENCE, W. J. C. 575.1: 634/635
The genetics of garden plants.
Macmillan, London, 1934, pp. 236, bibl. 11 pp., 10/6.

In their preface to this book the authors state that its object is twofold:—first, to give an introduction to the essential principles of genetics and cytology and, secondly, to give an account of recent results in relation to horticulture. The closely interrelated sciences of genetics and cytology have made such rapid progress during recent years and are still so little understood

by the majority of horticulturists, that a clear and lucid account of the principles underlying plant breeding practice by workers, who have themselves made notable contributions to our knowledge of the genetics of many horticultural plants, should be particularly welcome. In the first three chapters the authors deal in as clear and simple a manner as the technicalities of their subject will allow with the genetics of diploid and polyploid plants. The middle portion of the book is occupied by an account of the genetics of the chief flowering plants, vegetables and fruits. A vast amount of research work has been carried out during the past quarter of a century on the genetics of cultivated plants, but the majority of the results have been published in journals not easily available to the average horticulturist. Such a digest as that presented by the authors should be particularly valuable, since it welds together into a comparatively short but comprehensive summary the whole of the available information on the genetics of a wide range of plants. The concluding chapters deal with incompatibility and sterility in cultivated plants, subjects upon which the authors can speak with more than ordinary authority, while the final chapter on the origin of new plant forms illustrates in a striking manner how the practical plant breeder can utilize the vast fund of genetic and cytological knowledge now at his disposal in the origination of new varieties of plants of economic value. Sir A. D. Hall contributes a foreword, and at the end of the book will be found a comprehensive bibliography for those who wish to make a more intensive study of the subjects dealt with.

H.M.T.

159. WYE.

63(072)(05)

J.S.E. agric. Coll., Wye, 1935, No. 35, pp. 90, 2/6.

This gives an account of some of the agricultural activities of the college during the 1933-34 session. Brief reports are given by different departments, the advisory and the experimental work being dealt with separately. Among research items touched on briefly are *Entomology*:—*Anthonomus rubi* control, ovidical action of oil emulsions, possible new insecticides, pyrethrum growing, pests of mushrooms, the use of *Aphelinus mali* in the field, control of *Tetranychus telarius*. *Mycology*:—*Pseudoperonospora Humuli*, apple and pear scab control with bordeaux and with cotton-seed oil-bordeaux, hop viruses, mould resistance of new hop varieties, mushroom growing problems, marsh spot in seed peas. *Hops*:—Breeding work and manuring. *Engineering*. Further work on spraying apparatus, results of which are to be published in the July, 1935, number of the journal.

160. HORTICULTURAL EDUCATION ASSOCIATION.

634/5(058)

Scientific Horticulture, 1935, vol. 3, pp. 228, R. T. Pearl, editor, S.E.

Agric. Coll., Wye, Kent. 3/6 plus 5d. postage.

Volume III, helped admittedly by the inclusion of papers given at the refresher course at Reading, contains more than double the number of pages in Volume I. In our opinion the quality of the information is fully maintained. It is only fitting that the somewhat cumbrous title* adopted originally should give place to a shorter, more sonorous one explanatory of the contents. *Scientific Horticulture* does not ape other publications. Less erudite perhaps, but certainly more human than the *Journal of Pomology* and *Horticultural Science*, it caters not so much for the research worker as for the individual horticultural instructor and organizer, and we think that it certainly gives him value for money. Its articles are written always from the practical standpoint and it is the practical use of any scientific discovery which the horticultural organizer must present to his clients. The subjects dealt with primarily concern horticulture in these islands, but the same problems must in many cases be confronting horticulturists in other temperate parts of the Empire and the publication should prove of considerable value to them also. Short abstracts of certain of the articles are given in this number of *Horticultural Abstracts*. Subjects dealt with in articles which it has not been possible to abstract include the following:—Horticulture in Northern Ireland, twenty-one years' work at East Malling, manuring of vegetables, vegetables in relation to the canner, cultivation and soil problems and the heating of glasshouses, the connexion of Rothamsted research with horticulture. Finally, a short section of 7 pages is devoted to notices and reviews of books and other publications.

* Horticultural Education Association Year Book.